Fishery Data Series No. 13-35

Migratory Timing and Abundance Estimates of Sockeye Salmon into Upper Cook Inlet, Alaska, 2011

by

Pat Shields,

Mark Willette,

and

Aaron Dupuis

July 2013

Alaska Department of Fish and Game Divisions of Sport Fish and Commercial Fisheries

Symbols and Abbreviations

The following symbols and abbreviations, and others approved for the Système International d'Unités (SI), are used without definition in the following reports by the Divisions of Sport Fish and of Commercial Fisheries: Fishery Manuscripts, Fishery Data Series Reports, Fishery Management Reports, and Special Publications. All others, including deviations from definitions listed below, are noted in the text at first mention, as well as in the titles or footnotes of tables, and in figure or figure captions.

Weights and measures (metric)

centimeter	cm
deciliter	dL
gram	g
hectare	ha
kilogram	kg
kilometer	km
liter	L
meter	m
milliliter	mL
millimeter	mm

Weights and measures (English)

cubic feet per second	ft^3/s
foot	ft
gallon	gal
inch	in
mile	mi
nautical mile	nmi
ounce	oz
pound	lb
quart	qt
yard	yd

Time and temperature

day	d
degrees Celsius	°C
degrees Fahrenheit	°F
degrees kelvin	K
hour	h
minute	min
second	s

Physics and chemistry

all atomic symbols	
alternating current	AC
ampere	A
calorie	cal
direct current	DC
hertz	Hz
horsepower	hp
hydrogen ion activity (negative log of)	pH
parts per million	ppm
parts per thousand	ppt, ‰
volts	V
watts	W

General

Alaska Administrative Code	AAC
all commonly accepted abbreviations	e.g., Mr., Mrs., AM, PM, etc.
all commonly accepted professional titles	e.g., Dr., Ph.D., R.N., etc.
at	@
compass directions:	
east	E
north	N
south	S
west	W
copyright	©
corporate suffixes:	
Company	Co.
Corporation	Corp.
Incorporated	Inc.
Limited	Ltd.
District of Columbia	D.C.
et alii (and others)	et al.
et cetera (and so forth)	etc.
exempli gratia (for example)	e.g.
Federal Information Code	FIC
id est (that is)	i.e.
latitude or longitude	lat. or long.
monetary symbols (U.S.)	$, ¢
months (tables and figures): first three letters	Jan,...,Dec
registered trademark	®
trademark	™
United States (adjective)	U.S.
United States of America (noun)	USA
U.S.C.	United States Code
U.S. state	use two-letter abbreviations (e.g., AK, WA)

Mathematics, statistics

all standard mathematical signs, symbols and abbreviations	
alternate hypothesis	H_A
base of natural logarithm	*e*
catch per unit effort	CPUE
coefficient of variation	CV
common test statistics	(F, t, χ^2, etc.)
confidence interval	CI
correlation coefficient (multiple)	R
correlation coefficient (simple)	r
covariance	cov
degree (angular)	°
degrees of freedom	df
expected value	*E*
greater than	>
greater than or equal to	≥
harvest per unit effort	HPUE
less than	<
less than or equal to	≤
logarithm (natural)	ln
logarithm (base 10)	log
logarithm (specify base)	$log_{2,}$ etc.
minute (angular)	'
not significant	NS
null hypothesis	H_O
percent	%
probability	P
probability of a type I error (rejection of the null hypothesis when true)	α
probability of a type II error (acceptance of the null hypothesis when false)	β
second (angular)	"
standard deviation	SD
standard error	SE
variance	
population	Var
sample	var

FISHERY DATA SERIES NO. 13-35

MIGRATORY TIMING AND ABUNDANCE ESTIMATES OF SOCKEYE SALMON INTO UPPER COOK INLET, ALASKA, 2011

by
Pat Shields, Mark Willette, and Aaron Dupuis
Alaska Department of Fish and Game, Division of Commercial Fisheries, Soldotna

Alaska Department of Fish and Game
Division of Sport Fish, Research and Technical Services
333 Raspberry Road, Anchorage, Alaska, 99518-1565

July 2013

ADF&G Fishery Data Series was established in 1987 for the publication of Division of Sport Fish technically oriented results for a single project or group of closely related projects, and in 2004 became a joint divisional series with the Division of Commercial Fisheries. Fishery Data Series reports are intended for fishery and other technical professionals and are available through the Alaska State Library and on the Internet: http://www.adfg.alaska.gov/sf/publications/ This publication has undergone editorial and peer review.

Pat Shields, Mark Willette, and Aaron Dupuis
Alaska Department of Fish and Game, Division of Commercial Fisheries,
43961 Kalifornsky Beach Road, Suite B, Soldotna, AK 99669-8367, USA

This document should be cited as:
Shields, P., M. Willette, and A. Dupuis. 2013. Migratory timing and abundance estimates of sockeye salmon into Upper Cook Inlet, Alaska, 2011. Alaska Department of Fish and Game, Fishery Data Series No. 13-35, Anchorage.

TABLE OF CONTENTS

Page

LIST OF TABLES

LIST OF FIGURES

LIST OF APPENDICES

Appendix **Page**

ABSTRACT

In 2011, an offshore test fishery was conducted during the Upper Cook Inlet (UCI) commercial salmon fishing season. The test fishery was conducted from 1 July through 30 July and captured 5,660 sockeye salmon *Oncorhynchus nerka*, representing 3,715 catch per unit of effort (CPUE) index points. The midpoint of the 2011 sockeye salmon run at the test fishery occurred on 17 July, which was 2 days late relative to the historical mean date of 15 July. Two formal estimates of the size and timing of the 2011 sockeye salmon run were made during the commercial fishing season, with the first best-fit estimator from each analysis forecasting a total run to UCI of 11.56 and 9.13 million sockeye salmon, respectively. These estimates deviated from the actual total run of 8.6 million by 34% and 6%, respectively. Two estimates of the total Kenai River sockeye salmon run were also made using 5 best fit models. Based on data through 21 July, the total Kenai River run was projected to range between 6.68 and 11.11 million fish. The second estimate, made using data through 25 July, predicted the total Kenai River run would range between 5.41 and 8.32 million fish. The first best fit Kenai River total run estimate from each analysis (21 July–7.75 million, 25 July–7.74 million) differed from the preliminary postseason Kenai River total run estimate of 6.2 million fish by approximately 25%. In summary, 5 of the 10 Kenai River inseason run projections were within 20% of the actual run size. The final test fish passage rate was estimated at approximately 2,213 sockeye salmon per CPUE point. Genetic stock identification (GSI) of samples collected during the 2011 test fishery showed similar results to previous years.

Key words: Pacific salmon, *Oncorhynchus* spp., Upper Cook Inlet, Alaska, test fishery, migratory behavior, genetic stock identification (GSI)

INTRODUCTION

In 1979, the Alaska Department of Fish and Game (ADF&G) began an offshore test fish (OTF) project near the southern boundary of the Upper Cook Inlet (UCI) salmon management area (Figure 1). The project was designed to estimate the total sockeye salmon *Oncorhynchus nerka* run (including run timing) returning to UCI during the commercial salmon fishing season. These data have become extremely important to ADF&G staff, helping to adjust commercial fishing times and areas to most efficiently harvest surplus sockeye salmon or restrict fisheries that may overharvest specific stocks. In recent years, the Alaska Board of Fisheries has assembled various management plans requiring inseason abundance estimates of the annual sockeye salmon run to implement specific plan provisions. The OTF project has increasingly become one of the most important tools fishery managers utilize to make inseason fishery management decisions that comply with Alaska Board of Fisheries management directives.

Test fishing results have been reported annually since 1979 (Waltemyer 1983, 1984, 1986a, 1986b; Hilsinger and Waltemyer 1987; Hilsinger 1988; Tarbox and Waltemyer 1989; Tarbox 1990–1991, 1994–1999; Tarbox and King 1992; Shields 2000, 2001, 2003; Shields and Willette 2004–2005, 2007–2011). This report presents the results of the 2011 test fishing project.

OBJECTIVES

The objectives of the project were to:

1. make an inseason estimate of the 2011 UCI sockeye salmon total run (including run timing), and
2. estimate the 2011 Kenai River sockeye salmon run size.

METHODS

TEST FISHING

Sockeye salmon returning to UCI were sampled by fishing 6 geographically fixed stations between Anchor Point and the Red River Delta (Figure 1). These stations have been fished since 1992 (Tarbox 1994) and were established based on analyses that showed they provided the most reliable estimates of inseason run size and timing. Stations were numbered consecutively from east to west, with station locations (latitude and longitude) determined with global positioning system technology. A chartered test fishing vessel, *FV Americanus*, sampled all 6 stations (numbered 4, 5, 6, 6.5, 7 and 8) daily, traveling east to west on odd-numbered days and west to east on even-numbered days. Sampling started on 1 July and continued through 29 July. The vessel fished 366 m (1,200 ft or 200 fathoms) of multi-filament drift gillnet with a mesh size of 13 cm (5 1/8 inches). The net was 45 meshes deep and constructed of double knot Super Crystal[1] shade number 1, with filament size 53/S6F.

Catch and catch per unit of effort (CPUE) data for missed stations were interpolated by averaging catches from the day before and the day after for each station not fished. However, for stations where 3 or more consecutive days were missed, a different interpolation method was needed. This method used the proportion of the catch and CPUE for each station from all days fished previous to the missing values in order to estimate these parameters for any station where 3 or more consecutive days of fishing were missed.

The following physical and chemical readings were taken at the start of each set: air temperature, water temperature and salinity (at 1 m below the surface), wind velocity and direction, tide stage, water depth, and water clarity. Air and water temperatures (°C) and salinity (ppt) were measured using an YSI salinity/temperature meter. Wind speed was measured in knots and direction was recorded as 0 (no wind), 1 (north), 2 (northeast), 3 (east), 4 (southeast), 5 (south), 6 (southwest), 7 (west), or 8 (northwest) using a Kestrel 4000 pocket weather tracker. Tide stage was classified as 1 (high slack), 2 (low slack), 3 (flooding), or 4 (ebbing) by observing the movement of the vessel while drifting with the gill net. Water depth was measured in fathoms (fm) using a Simrad echo sounder, and water clarity was measured in meters (m) using a 17.5 cm secchi disk, following methods described by Koenings et al. (1987).

All salmon captured in the drift gillnet were identified by species and enumerated. Sockeye salmon (n<50 at each station) were measured for fork length (mideye to fork of tail) to the nearest mm and also had an axillary process removed for genetic analysis (as described by Habicht et al. 2007).

The number of fish captured at each station (s) on each day (i) was expressed as a CPUE statistic, or index point, and standardized to the number of fish caught in 100 fathoms of gear in hour of fishing time:

$$CPUE_{s,i} = \frac{100\,fm \;\; x \;\; 60\,\text{min} \;\; x \;\; number\ of\ fish}{fm\ of\ gear \;\; x \;\; MFT}. \tag{1}$$

[1] Product names used in this report are included for scientific completeness, but do not constitute a product endorsement.

Mean fishing time (*MFT*) was:

$$MFT = (C - B) + \frac{(\mathrm{B} - \mathrm{A}) + (\mathrm{D} - \mathrm{C})}{2}, \quad (2)$$

where: A = time net deployment started,

B = time net fully deployed,

C = time net retrieval started, and

D = time net fully retrieved.

Once deployed at a station, the drift gillnet fished 30 minutes before retrieval started. However, the net was capable of capturing fish prior to being fully deployed, as it was during the time it was being retrieved. *MFT* was therefore adjusted by summing the total time it took to set and retrieve the net, then dividing this time in half, and adding it to the time when the entire net was deployed and fished.

Daily $CPUE_i$ data were summed for all *m* stations (typically 6) as follows:

$$CPUE_i = \sum_{s=1}^{m} CPUE_{s,i}\ . \quad (3)$$

Cumulative $CPUE_i$ ($CCPUE_d$) was given by:

$$CCPUE_d = \sum_{i=1}^{d} CPUE_i\ , \quad (4)$$

where:

d = date of the estimate.

DESCRIBING THE SALMON MIGRATION AND PROJECTING TOTAL RUN

The sockeye salmon run was described for each of the previous years based on the respective test fishing data, as described in Mundy (1979):

$$Y_{yr,d} = 1 \big/ (1 + e^{-(\mathrm{a} + \mathrm{bd})})\ , \quad (5)$$

where:

$Y_{yr,d}$ = modeled cumulative proportion of $CCPUE_{yr,f}$ (*f* = final day of season) for year *yr* as of day *d*, and

a and *b* = model parameters.

Variables without the subscript *yr* indicating year refer to the current year's estimate. To determine which of the previous run timing curves most closely fit the current year's data, and to estimate total run for the entire season (TR_f), a projection of the current year's $CCPUE_d$ at the end of the season ($CCPUE_f$) was estimated as per Waltemyer (1983):

$$CCPUE_f = \frac{\sum_{d=0}^{D} CCPUE_d{}^2}{\sum_{d=0}^{d} Y_{yr,d} \cdot CCPUE_d}. \tag{6}$$

This model assumes that the modeled cumulative proportions ($Y_{yr,d}$) for previous year *yr* is the same as for the current year (Mundy 1979). To test this assumption, inseason Y_d was estimated as:

$$Y_d = \frac{CCPUE_d}{CCPUE_f}, \tag{7}$$

and mean squared error (*MSE*) between Y_d and $Y_{yr,d}$ was estimated as:

$$MSE = \frac{\sum_{d=0}^{D} \left(Y_{yr,d} - Y_d\right)^2}{d+1}. \tag{8}$$

Years were ranked from lowest *MSE* (best model) to highest (worst), and the best fit years were used to estimate $CCPUE_f$ for the current year. Catchability, or the fraction of the available population taken by a defined unit of fishing effort, was estimated as:

$$q_d = \frac{CCPUE_d}{r_d}, \tag{9}$$

where:

q_d = estimated cumulative catchability as of day *d*, and

r_d = cumulative total run as of day *d*.

The cumulative total run on day *d* was the sum of all estimates for commercial, recreational, and personal use harvests to date, total escapement to date, and the number of residual (i.e., residing) sockeye salmon in the district. Commercial harvest data was estimated inseason from catch reports called or faxed into the ADF&G office. All commercially harvested salmon in UCI, whether sold or kept for personal use, are required to be reported to the Soldotna ADF&G office by the fishermen or processors within 12 hours of the close of a fishing period. Personal use and recreational harvests were estimated inseason by examining catch statistics from previous years' fisheries on similar sized runs. Total escapement to date included estimated escapements into all monitored systems (Crescent, Susitna, Kenai and Kasilof rivers, and Fish Creek) and unmonitored systems, which are assumed to be 15% of the escapement into monitored systems (Tobias and Willette 2003). The number of residual fish in the district was estimated by assuming exploitation rates of 70% in set net fisheries, 35–40% in districtwide drift net fisheries (based on the number of boats that fished), and 25% in reduced district drift net fisheries (Mundy et al. 1993). For example, if the drift gillnet fleet harvested 500,000 sockeye salmon on an inletwide fishing period, the number of sockeye salmon originally in the district would be 1,250,000 (500/0.40=1,250) where the number remaining, or the residual, is 750,000 (1,250–500=750).

Passage rate, as of day *d*, the expansion factor used to convert CPUE into estimated numbers of salmon passing the test fishing transect line into UCI, was

$$PR_d = 1/q_d \ . \tag{10}$$

Total run at the end of the season (TR_f) was

$$TR_f = PR_d \cdot CCPUE_f. \tag{11}$$

The midpoint of the run, M, the day that approximately 50% of the total run has passed the OTF transect, was

$$M = a/b\,, \tag{12}$$

where:

a and b = model parameters.

Because the test fishery does not encompass the entire sockeye salmon run, the total $CCPUE_f$ for the test fishery is estimated postseason using 2 methods (Equations 13 and 14):

$$CCPUE_f^h = CCPUE_f \cdot \frac{H_t}{H_L}\,, \tag{13}$$

where:

$CCPUE_f^h$ = total estimated $CCPUE_f$ for the season, based on harvest,

H_t = total commercial harvest for the season,

H_L = total commercial harvest through final day of test fishery (f+2), and

L = number of days (lag time) it took salmon to travel from test fishery to commercial harvest areas (2 days).

$$CCPUE_t^r = CCPUE_f \cdot \frac{E_t + H_t}{E_L + H_L}\,, \tag{14}$$

where:

$CCPUE_t^r$ = total estimated $CCPUE_f$ for the season, based upon total run,

E_t = total escapement for the season,

H_t = total commercial harvest for the season,

E_L = total UCI escapement through the final day of the test fishery, summed from 6 different streams,

H_L = total UCI commercial harvest through the final day of the test fishery, and

L = number of days (lag time) it took salmon to travel from the test fishery to spawning streams or commercial harvest areas.

The total run adjustment to $CCPUE_f$ (Equation 14) has replaced adjustments based on harvest alone (Equation 13), primarily due to changes to commercial fishing management plans made by the Alaska Board of Fisheries. Management plans now provide much less fishing time in August than in the past; therefore, adjustments based on harvest alone would not have accurately reflected the additional fish that entered the district after the test fishery ceased. The total run to date on the last day of the test fishery was the sum of all commercial harvest data and escapement. Escapement estimates were derived by summing passage from 3 sockeye salmon sonar enumeration sites (Kenai, Kasilof, and Crescent rivers) and adding to that an expansion of the cumulative weir counts at Chelatna, Judd, and Larson lakes to reflect the total Susitna River sockeye salmon escapement, plus the weir count at Fish Creek, and an estimate of escapement to all unmonitored systems through day *d*. An estimate of escapement to all non-monitored systems in UCI is considered to be 15% of the monitored runs. Lag times are the approximate time for fish to migrate from the test fish transect to a particular destination. As suggested by Mundy et al. (1993), lag times must be considered when estimating the total run passing the test fish transect on day *d*. A lag time of up to 2 days was assumed for fish harvested in the commercial fishery. We estimated lag times between the test fishery and escapement projects as follows: Crescent River, 1 day; Kasilof and Kenai rivers, 4 days; Fish Creek, 7 days (Mundy et al. 1993); and Susitna River weirs, 14 days. The number of sockeye salmon harvested in sport and personal use fisheries after test fishing has ceased that have not been estimated in the escapement are assumed to be insignificant, and therefore are not utilized in the $CCPUE_f$ post-test fishery adjustment.

Adjusted estimates of $CCPUE_f$ ($CCPUE_t^h$ and $CCPUE_t^r$) were used for postseason estimates of TR_f.

RESULTS AND DISCUSSION

In 2011, all stations were fished daily from 1 to 30 July, 2012 (Table 1), which meant no interpolation was required for estimating catches from missed stations. A total of 5,660 sockeye salmon were captured during the 2011 test fishery, as well as 90 pink salmon *O. gorbuscha*, 768 chum salmon *O. keta*, 374 coho salmon *O. kisutch*, and 7 Chinook salmon *O. tshawytscha* (Tables 1–2; Appendices A1–A13). Sockeye salmon daily catches ranged from 5 fish on 7 July to 657 fish on 15 July. The total sockeye salmon $CCPUE_f$ for the 2011 project was 3,715 with daily CPUE values ranging from 4 to 378 (Table 1). The $CCPUE_f$ of 3,715 represented the highest unadjusted $CCPUE_f$ since 1992 (Tables 3 and 4), which is when the number of stations sampled by the test fish boat was standardized to the current configuration (Tarbox 1994). The 1992–2011 annual test fish unadjusted $CCPUE_f$ and the total annual run of sockeye salmon to UCI (Figure 2) were significantly (α=0.05) correlated (P=0.023 and r^2=0.25); however 75% of the variation remains unexplained, indicating that the $CCPUE_f$ statistic by itself would not be a reliable predictor of the total annual sockeye salmon run.

As expected, the distribution of sockeye salmon catches along the test fish transect was similar to the distribution of CPUE values (Tables 2 and 3), since fishing occurs at fixed intervals at each station.

INSEASON ABUNDANCE ESTIMATES

Tarbox and Waltemyer (1989) provided detail about the assumptions used in the curve fitting procedures to estimate the $CCPUE_f$ statistic during the season. One of the major assumptions is that 24 June represents the first day of the sockeye salmon run to UCI. Variability in actual runs can therefore result in an average or early run being misclassified as late, especially during the first couple weeks of the test fish program. For this reason, 20 July was chosen as the earliest date that inseason formal estimates of each year's total run size and run timing should be made. By then, there are enough data points in the current year's run timing curve to provide a more accurate estimate of the $CCPUE_f$. In addition, Tarbox and King (1992) and later OTF annual reports demonstrated that the initial first choice (best fit) estimate of the $CCPUE_f$ statistic and total run made around mid-July was often not the best fit estimate later in July. Therefore, when making formal inseason estimates of the total run, the top 5 or 6 best fits are evaluated. Careful consideration is given to years whose fits reveal the least day to day change in the predicted $CCPUE_f$. These years are identified as potentially being the final best fit at the end of the season, especially if the *MSE* (Equation 8), also referred to as the mean sum of squares, statistic is also improving. Salmon run timing from other areas of the state is also considered to help better predict UCI run timing (Willette et al. 2010).

The first formal abundance estimate of the 2011 UCI sockeye salmon run occurred on 22 July, using commercial, sport and personal use harvests, escapement, and test fishery data through 21 July (Table 5). The 2011 test fish $CCPUE_d$ curve was mathematically compared to run curves from 1979 through 2010, with the estimates ranked from best to worst based on *MSE*. The passage rate was estimated to be 2,477 based on a run of 6.2 million fish through 21 July (includes residual fish abundance in the district). The 2011 test fish $CCPUE_d$ curve most closely tracked the 1990 run, estimating a $CCPUE_f$ of 4,666 index points. Given a passage rate of 2,477, the total run estimate was 11.56 million fish. As cautioned earlier, the first best fit (lowest *MSE*) on approximately 20 July often turns out not to be the best fit at the end of July, so the top 5 fits were considered, which included run timing curves from 1992, 1999, 2006, and 1987 (in order of best fit). Using these data, total run estimates ranged from 9.94 to 16.60 million sockeye salmon. The best fits included runs from 2 to 9 days late, reinforcing department staff’s confidence in late-run curves.

The second formal estimate of the total run of sockeye salmon to UCI in 2011 followed the 25 July inletwide drift gillnet commercial fishing period (Table 5). At that time, the run to date was estimated at 7.47 million fish, with a $CCPUE_d$ of 3,201. The passage rate was therefore estimated to be 2,332 fish per CPUE point. The current $CCPUE_d$ curve changed from the earlier estimate, now most closely tracking the 1992 run, and projected a $CCPUE_f$ of 3,914 and a total run of 9.13 million fish. The top 5 best fits all tracked runs that were 2 to 9 days late and projected a total run to UCI ranging from 9.12 to 14.99 million fish.

The total sockeye salmon run to UCI in 2011 (postseason data) was estimated at approximately 8.6 million fish, including commercial, sport, and personal use harvests, as well as escapement to all systems. Therefore, the first best fit total run estimates from the 2 formal inseason projections of the 2011 run were approximately 34% and 6% higher, respectively, than the actual run size. However, because the top 5 best fits from each analysis were given careful consideration inseason, the range in error from these projections are highlighted here. Based on data through 21 July, the difference between the projected total run to UCI and the actual value ranged from 16% to 93%. Using the test fish data through 25 July, the error ranged from 6% to 74%, with the best fit data projecting a total run that was within 6% of the actual value.

KENAI RIVER RUN ESTIMATE

In addition to making inseason estimates of the total size of the annual sockeye salmon run, UCI commercial fishery management plans require the department to make an inseason estimate of the number of Kenai River sockeye salmon in the run. Various management actions in both sport and commercial fisheries are tied to the total abundance of Kenai River sockeye salmon, which is characterized by 3 different size ranges: less than 2.3 million fish, between 2.3 and 4.6 million fish, and greater than 4.6 million fish (Shields and Dupuis 2012). As previously described, the $CCPUE_d$

curves from the top 5 best fits of previous year's test fish data were used to project the $CCPUE_f$ for 2011, which was then used to estimate the UCI total run. The Kenai River component of the run was determined in part from a weighted age-composition allocation method to estimate the stock composition of the commercial harvest (Tobias and Tarbox 1999). This method (Bernard 1983) allocates the commercial harvest to various stocks by comparing the age composition of the escapement in the major river systems of UCI to the age composition of sockeye salmon harvested commercially (Tobias and Willette 2004). Three important assumptions of the weighted age-composition method are that: 1) the age compositions of fish escaping into the various river systems are representative of the age composition in the commercial harvest; 2) the commercial harvest in specific areas is composed of nearby stocks; and 3) exploitation rates are equal among stocks within age classes. The Kenai River run to date is estimated by summing: 1) the commercial harvest of Kenai River stocks; 2) the estimated passage in the Kenai River; and 3) an estimate of sport and personal use harvest below the river mile 19 sonar site. Finally, the remainder of the run that will be Kenai River origin is projected by subtracting the run to date from the total run estimate, and then applying an estimate of the proportion of the run remaining that will be Kenai River by reviewing previous years' data for runs of similar timing.

Using the 21 July total UCI run estimate, the total Kenai River sockeye salmon run was projected to range between 6.68 and 11.11 million fish (Table 6). Assuming 3.66 million Kenai River sockeye salmon had returned to date, that meant 3.03 to 7.46 million fish remained in the run. The preseason forecast for the Kenai River had projected a total run of 3.94 million fish, requiring commercial fisheries management to follow guidelines for a run of 2.3 to 4.6 million sockeye salmon. However, all of the top 5 best fit estimators from the 21 July assessment were projecting a Kenai River run greater than 4.6 million fish, with estimates as high as 11.11 million fish. The significant variation between the preseason forecast and the 21 July assessment indicated to staff that the appropriate commercial fishery management approach would be to follow the guidelines for a run to the Kenai River greater than 4.6 million fish. A few days later (on 25 July), the Kenai River run assessment was updated. The top 5 best fits tracked runs that were classified from on time to 7 days late. The total Kenai River run was projected to range between 5.41 and 8.32 million fish (Table 6). That said, approximately 4.73 million sockeye salmon had already been accounted for in the run to date, which left 0.67 to 3.59 million Kenai River fish remaining in the 2011 run (assuming 67% of the run remaining would be Kenai River stock). Because the estimated Kenai River run to date had already exceeded 4.6 million sockeye salmon, ADF&G staff continued to follow the guidelines for a Kenai River run greater than 4.6 million fish.

Postseason data showed the 2011 Kenai River sockeye salmon run to be approximately 6.2 million fish. The total run estimate included sport (preliminary), personal use, and educational fishery annual harvest estimates; the final sport harvest estimates were not available at publication. The inseason estimates of the Kenai River total run deviated from the actual run by 8% to 79% using data through 21 July, and by 9% to 34% using data through 25 July. The first best fit estimators from each time frame projected a total Kenai River run that was 25% more than the actual run. In summary, 5 of the 10 estimates of Kenai River total run size from the 21 July and 25 July analyses were within 20% of the actual estimated final run. Once again, test fish projections were a critical tool that managers relied on in making difficult inseason decisions.

OTF ERROR

The absolute percent error (APE) between actual total run and *CCPUE* predicted total run in the 20 July estimate (or shortly thereafter) has been >30% only for runs 1 or more days early (Table 7; Figure 3). For all early runs, the mean APE is 38% (median=25%), while for runs on time or late, the 20 July mean APE is only 11% (median=7%). As stated earlier, the 20 July first best fit estimator has proven over time to not always be the best fit of the data just a few days later; this was the case in 2011. Using data through 21 July, the first best fit estimator most closely tracked the 1990 run, which was a 3 day late run, and projected a total return that was approximately 34% more than the actual run. Just a few days later the first best fit estimator had changed and was tracking the 1992 run, and projected a total run at this time that ended up being approximately 6% more than the actual run.

RUN TIMING

The last day of test fishing typically occurs on 30 July each year, which means the "tail-end" of the sockeye salmon run is not assessed by the project. In 2011, the test fish project ended on 30 July, but escapement monitoring continued through 1 August in the Crescent River, 11 August in the Kasilof River, 13 August in the Kenai River, 15 August at Fish Creek and into the first week of September at Judd, Chelatna, and Larson lakes. In addition, commercial fishing also continued into September. Therefore, to estimate the proportion of the run that occurred after the test fishery ceased, 2 methods were used to adjust the $CCPUE_f$ statistic to reflect what it would have been had the project continued through the end of the sockeye salmon run.

The first method used the number of fish harvested commercially after the test fishery ended (Equation 13), while the second method enumerated both escapement and commercial catch (total run) after the test fishery terminated (Equation 14). The sport and personal use harvest of sockeye salmon occurring after the test fishery was assumed to be minimal because the major personal use fisheries are either closed or slowing down at this point, and sport fisheries begin to target coho salmon; therefore these were not considered. Although differences between annual inseason and postseason (adjusted by either harvest or total run) $CCPUE_f$ statistics were often relatively minor, they affected calculations of the *a* and *b* coefficients in the equations used to describe historical run timing curves (Equation 5), which in turn had an effect on estimates of subsequent $CCPUE_f$ values (Table 4). Beginning in 2002, the total run method was used to make postseason adjustments to all previous years' $CCPUE_f$ statistics (Shields 2003). For the 2011 season, the test fish $CCPUE_f$ of 3,715 was adjusted to 3,835 based on the number of fish that were commercially harvested and escaped after the test fishery ceased (Table 4). Therefore, this method estimated that approximately 5% of the sockeye salmon run occurred after the test fishery terminated. Historical *a* and *b* coefficients calculated using total run-adjusted $CCPUE_f$ values are now used for all inseason run projections. Using the total run-adjusted values, the relationship between total run (logged) and test fishery $CCPUE_f$ was significantly (α=0.05) correlated (P=0.012 and r^2=0.29), yet 71% of the variation remains unexplained. Therefore, like the unadjusted $CCPUE_f$ statistic, using the total run-adjusted $CCPUE_f$ statistic by itself may not be a reliable predictor of the total annual sockeye salmon run.

A nonlinear mathematical model (Mundy 1979) was fit to the $CCPUE_d$ proportions of the 2011 sockeye salmon run to UCI. Using the total run-adjusted $CCPUE_f$, this analysis suggested that 2.4% of the run had passed the OTF transect line prior to the start of test fishing on 1 July, and that the run was approximately 95% complete at project termination on 30 July (Figure 4 and

Appendix A14). Therefore, the mathematical model suggests the 2011 test fishery covered approximately 93% of the run. The test fish passage rate for the season can be calculated by dividing the total number available to capture by the test fishery by the unadjusted $CCPUE_f$. In 2011, the estimated final passage rate was 2,213.

The midpoint of the 2011 UCI sockeye salmon run, or the day on which approximately 50% of the total run had entered UCI at the test fish transect, occurred on day 24.1, or 17 July, which was 2 days late compared to the historical mean date of 15 July (Table 8).

ENVIRONMENTAL VARIABLES

Surface water temperatures measured along the test fish transect ranged from 7.8°C to 13.9°C and averaged 9.8°C for the year (Appendices A15 and A16). These water temperature data were very similar to the 1992–2010 average surface water temperature of 10.3°C (Appendix A17). Water temperatures are believed by many to play a significant role in the timing of salmon runs (Burgner 1980), so these data have been closely monitored. In general, warmer water temperatures are thought to result in early runs, while cooler temperatures produce later runs. For example, in Bristol Bay, Burgner (1980) reported that the arrival dates of sockeye salmon were early during years when water temperatures were warmer than average. In a later Bristol Bay study, Ruggerone (1997) found that the change in temperature from winter to spring was a better predictor of run timing than water temperature alone. However, water temperature data alone may or may not be an accurate predictive tool for gauging the run timing of UCI salmon stocks. The 2005 UCI sockeye salmon run was the second latest run ever observed, yet surface water temperatures along the test fish transect were the warmest ever measured. Conversely, the 2008 run was 4 days early, yet surface water temperatures were much cooler than average. Therefore, it appears that factors other than just water temperature likely play a role in determining salmon run timing in UCI. Pearcy (1992) summarized some of the factors that affect the coastal migration of returning adult salmon. He reviewed the orientation mechanisms used by salmon in coastal waters and concluded that prior to entering estuaries adult salmon probably rely on cues that are different from those used in the open ocean phases of their migration.

Salinity, temperature, currents, and bathymetry were all thought to play a role in migration. Another dynamic to consider that could affect run timing is the age composition of the run, which relates to fish size; larger fish swim faster than smaller fish (Flynn and Hilborn 2004). Finally, it should be noted that when classifying total sockeye salmon run timing in UCI, the magnitude of the Kenai River run should be considered. Kenai River sockeye salmon return to UCI later than any other numerically significant stock, and because the Kenai River run is the largest in UCI, runs classified as late in general tend to be large Kenai River runs. For example, from 1979 to 2011, the average Kenai River annual run (DIDSON-based) for years where the UCI return was classified as early (n=13), was 2.8 million fish, yet for UCI runs classified as on time or late (n=20), the Kenai River run averaged 4.4 million fish. Thus, a combination of these factors (water temperature, salinity, currents, bathymetry, fish size, and stock composition of the run) likely affects fish migration and ultimately classifying the run timing as early or late.

In an attempt to better understand and predict sockeye salmon migrations into UCI, ADF&G conducted a companion study on the test fish vessel from 2002 to 2005. Using side-looking sonar, fish distribution in the water column was measured in relation to various oceanographic data, such as water temperature, salinity, tide stage, and water clarity. These data (Appendices A15–A17) have not been published yet, but one of the objectives of the study was to determine whether or not the OTF inseason run forecasting model could be improved using this additional information.

In 2011, air temperatures along the test fish transect ranged from 9° to 17°C and averaged 11.5°C, or the tenth coldest average air temperature since the test fishery began in 1979. Wind velocity averaged 3.9 knots for the month, which was the calmest year since 1979. Wind direction was variable, but in general, winds originated out of the south, the predominate wind orientation in UCI during July. The 2011 seasonal average salinity of 30.4 ppt was slightly higher than the 1992–2010 average of 29.5 ppt. Koenings et al. (1987) describe a secchi disk as a black and white circular plate that is used to easily estimate the degree of visibility in natural waters. Secchi disk readings in 2011 were similar to the averages from all previous years. In general, water clarity along the test fish transect decreases as you travel from east to west as a result of numerous glacial watersheds draining into the west side of Cook Inlet. From 2001 to 2010, the average secchi disk depth was 7.9 m at station 4 (Figure 1) and decreased to 3.0 m at station 8. Finally, station 4 was the shallowest station, averaging 23.8 fathoms (144 feet) in depth. Changes in depth are a result of different stages of tide as well as minor differences in set location from day to day.

GSI ANALYSIS

ADF&G has developed and refined sockeye salmon genetic stock identification techniques (GSI) since the early 1990s (Seeb et al. 1997, 2000; Habicht et al. 2007; Barclay et al. 2010a, 2010b). Beginning in 2006, fish captured in the test fishery that were previously measured to estimate mean length were also sampled for GSI analysis. Approximately 9,500 samples collected from 2006–2010 were successfully genotyped (Tables 9 and 10). Samples were pooled into discrete time periods to meet sample size goals (n=400), resulting in 4 periods in 2006 and 2008, 5 periods in 2007 and 2010, and 6 periods in 2009. The data from these 5 years revealed similar findings (i.e., during the third and fourth weeks in July, Kenai River sockeye salmon were the dominant stock entering Cook Inlet, whereas during the first part of the month, Kasilof River sockeye salmon stocks were equally or more abundant than Kenai River stocks). The GSI analyses also showed that Susitna River sockeye salmon stocks (labeled as JCL and SusYen) comprised 11% of all fish captured in 2006, 12% in 2007, 13% in 2008, 9% in 2009, and 7% in 2011 (unweighted average). The 2011 test fish samples had not been analyzed at the time this report was prepared.

The efficacy of using GSI analyses in combination with the test fishery for inseason management of the UCI commercial fishery remains unclear. While it could be useful to know when specific stocks are entering the Central District, inter and intra-annual variability in migration routes through the district would make adjusting commercial fishing periods to increase or decrease stock-specific exploitation problematic. Therefore, in order to better understand the spatial and temporal distribution of sockeye salmon stocks transiting the Central District, ADF&G sought and received funding from the Alaska legislature to conduct a second UCI test fishery beginning with the 2012 season. The new test fish transect was positioned farther north in Central District and fished on a daily schedule similar to the Anchor Point test fishery (Figure 1). We collected GSI samples from sockeye salmon captured at each station on the new transect to determine, for instance, whether or not Susitna River sockeye salmon stocks separate from Kenai and Kasilof river stocks as these fish migrate through UCI. Undoubtedly, GSI data will continue to serve as the foundation for future research projects aimed at more clearly understanding stock-specific run timing and migration through UCI. At the time of this publication, results from the 2012 second OTF sites have not been published.

The UCI test fishery continues to provide fishery managers with very important data about sockeye salmon abundance and timing. Since commercial, sport, and personal use fishery management plans depend on inseason sockeye salmon run estimates, the UCI test fishery project remains one of the most essential tools available for their management.

ACKNOWLEDGEMENTS

The authors would like to thank Robert Maw, captain of the *F/V Americanus*, and the test fishery crew members for conducting safe and efficient maritime activities.

REFERENCES CITED

Barclay, A. W., C. Habicht, W. D. Templin, H. A. Hoyt, T. Tobias, and T. M. Willette. 2010a. Genetic stock identification of Upper Cook Inlet sockeye salmon harvest, 2005-2008. Alaska Department of Fish and Game, Fishery Manuscript No. 10-01, Anchorage.

Barclay, A. W., C. Habicht, T. Tobias, and T. M. Willette. 2010b. Genetic stock identification of Upper Cook Inlet sockeye salmon harvest, 2009. Alaska Department of Fish and Game, Fishery Data Series No. 10-93, Anchorage.

Bernard, D. R. 1983. Variance and bias of catch allocations that use the age composition of escapements. Alaska Department of Fish and Game, Division of Commercial Fisheries, Informational Leaflet No. 227, Anchorage. http://www.sf.adfg.state.ak.us/FedAidPDFs/afrbil.227.pdf

Burgner, R. L. 1980. Some features of the ocean migrations and timing of Pacific salmon. Pages 153-163. [*In*] Salmonid ecosystems of the north Pacific. W. J. McNeil and D. C. Himsworth, editors. Oregon State University Press, Corvallis, OR.

Flynn L., and R. Hilborn. 2004. Test fishery indices for sockeye salmon (*Oncorhynchus nerka*) as affected by age composition and environmental variables. Canadian Journal of Fisheries and Aquatic Science 61:80-92.

Habicht, C., W. D. Templin, L. W. Seeb, L. F. Fair, T. M. Willette, S. W. Raborn, and T. L. Lingnau. 2007. Postseason stock composition analysis of Upper Cook Inlet sockeye salmon harvest, 2005–2007. Alaska Department of Fish and Game, Fishery Manuscript No. 07-07, Anchorage.

Hilsinger, J. R. 1988. Run strength analysis of the 1987 sockeye salmon return to Upper Cook Inlet, Alaska. Alaska Department of Fish and Game, Division of Commercial Fisheries, Regional Information Report 2A88-19, Anchorage.

Hilsinger, J. R., and D. Waltemyer. 1987. Run strength analysis of the 1986 sockeye salmon return to Upper Cook Inlet, Alaska. Alaska Department of Fish and Game, Division of Commercial Fisheries, Upper Cook Inlet Area Data Report 87-6, Soldotna.

Koenings, J. P., J. A. Edmundson, G. B. Kyle, and J. M. Edmundson. 1987. Limnology field and laboratory manual: Methods for assessing aquatic production. Alaska Department of Fish and Game, FRED Division Report Series No. 71. Soldotna.

Mundy, P. R. 1979. A quantitative measure of migratory timing illustrated by application to the management of commercial salmon fisheries. Doctoral dissertation, University of Washington, Seattle.

Mundy, P. R., K. K. English, W. J. Gazey, and K. E. Tarbox. 1993. Evaluation of the harvest management strategies applied to sockeye salmon populations of Upper Cook Inlet, Alaska, using run reconstruction analysis. [*In*]: G. Kruse, D. M. Eggers, R. J. Marasco, C. Pautzke, and T. J. Quinn II editors. Proceedings of the international symposium on management strategies for exploited fish populations. Alaska Sea Grant College Program, University of Alaska, Fairbanks.

Pearcy, W. G. 1992. Ocean ecology of North Pacific salmonids. Washington Sea Grant Program. University of Washington Press, Seattle.

Ruggerone, G. T. 1997. Preseason forecast of sockeye salmon run timing in Bristol Bay, Alaska, 1996. Prepared for Bristol Bay salmon processors by Natural Resources Consultants, Seattle.

Seeb, L. W., C. Habicht, W. D. Templin, K. E. Tarbox, R Z. Davis, L. K. Brannian, and J. E. Seeb. 2000. Genetic diversity of sockeye salmon of Cook Inlet, Alaska, and its application to management of populations affected by the Exxon Valdez oil spill. Transactions of the American Fisheries Society 129:1223–1249.

Seeb, L. W., W. D. Templin, K. E. Tarbox, R. Z. Davis, and J. E. Seeb. 1997. Kenai River sockeye salmon restoration, Restoration Project 96255-2 Final Report, *Exxon Valdez* Oil Spill Trustee Council, Anchorage.

Shields, P. 2000. An estimate of the migratory timing and abundance of sockeye salmon into Upper Cook Inlet, Alaska, in 2000. Alaska Department of Fish and Game, Division of Commercial Fisheries, Regional Information Report 2A00-30, Anchorage.

Shields, P. 2001. An estimate of the migratory timing and abundance of sockeye salmon into Upper Cook Inlet, Alaska, in 2001. Alaska Department of Fish and Game, Division of Commercial Fisheries, Regional Information Report 2A01-14, Anchorage.

Shields, P. 2003. An estimate of the migratory timing and abundance of sockeye salmon into Upper Cook Inlet, Alaska, in 2002. Alaska Department of Fish and Game, Division of Commercial Fisheries, Regional Information Report 2A03-01, Anchorage.

Shields, P., and A. Dupuis. 2012. Upper Cook Inlet commercial fisheries annual management report, 2011. Alaska Department of Fish and Game, Fishery Management Report No. 12-25, Anchorage.

Shields, P., and T. M. Willette. 2004. An estimate of the migratory timing and abundance of sockeye salmon into Upper Cook Inlet, Alaska, in 2003. Alaska Department of Fish and Game, Division of Commercial Fisheries, Regional Information Report 2A04-15, Anchorage.

Shields, P., and T. M. Willette. 2005. An estimate of the migratory timing and abundance of sockeye salmon into Upper Cook Inlet, Alaska, 2004. Alaska Department of Fish and Game, Fishery Data Series No. 05-64, Anchorage.

Shields, P., and T. M. Willette. 2007. An estimate of the migratory timing and abundance of sockeye salmon into Upper Cook Inlet, Alaska, 2005. Alaska Department of Fish and Game, Fishery Data Series No. 07-39, Anchorage.

Shields, P., and T. M. Willette. 2008. An estimate of the migratory timing and abundance of sockeye salmon into Upper Cook Inlet, Alaska, 2006. Alaska Department of Fish and Game, Fishery Data Series No. 08-53 Anchorage.

Shields, P., and T. M. Willette. 2009a. Migratory timing and abundance estimates of sockeye salmon into Upper Cook Inlet, Alaska, 2007. Alaska Department of Fish and Game, Fishery Data Series No. 09-15, Anchorage.

Shields, P., and T. M. Willette. 2009b. Migratory timing and abundance estimates of sockeye salmon into Upper Cook Inlet, Alaska, 2008. Alaska Department of Fish and Game, Fishery Data Series No. 09-59, Anchorage.

Shields, P., and T. M. Willette. 2010. Migratory timing and abundance estimates of sockeye salmon into Upper Cook Inlet, Alaska, 2009. Alaska Department of Fish and Game, Fishery Data Series No. 10-56, Anchorage.

Shields, P., and T. M. Willette. 2011. Migratory timing and abundance estimates of sockeye salmon into Upper Cook Inlet, Alaska, 2010. Alaska Department of Fish and Game, Fishery Data Series No. 11-74, Anchorage.

Tarbox, K. E. 1990. An estimate of the migratory timing of sockeye salmon into Upper Cook, Alaska, in 1989 using a test fishery. Alaska Department of Fish and Game, Division of Commercial Fisheries, Regional Information Report 2S90-04, Anchorage.

Tarbox, K. E. 1991. An estimate of the migratory timing of sockeye salmon into Upper Cook, Alaska, in 1990 using a test fishery. Alaska Department of Fish and Game, Division of Commercial Fisheries, Regional Information Report 2S91-06, Anchorage.

Tarbox, K. E. 1994. An estimate of the migratory timing and abundance of sockeye salmon into Upper Cook Inlet, Alaska, in 1993. Alaska Department of Fish and Game, Division of Commercial Fisheries, Regional Information Report 2A94-13, Anchorage.

Tarbox, K. E. 1995. An estimate of migratory timing and abundance of sockeye salmon into Upper Cook Inlet, Alaska, in 1994. Alaska Department of Fish and Game, Division of Commercial Fisheries, Regional Information Report 2A95-15, Anchorage.

Tarbox, K. E. 1996. An estimate of migratory timing and abundance of sockeye salmon into Upper Cook Inlet, Alaska, in 1995. Alaska Department of Fish and Game, Division of Commercial Fisheries, Regional Information Report 2A96-07, Anchorage.

REFERENCES CITED (Continued)

Tarbox, K. E. 1997. An estimate of migratory timing and abundance of sockeye salmon into Upper Cook Inlet, Alaska, in 1996. Alaska Department of Fish and Game, Division of Commercial Fisheries, Regional Information Report 2A97-01, Anchorage.

Tarbox, K. E. 1998a. An estimate of migratory timing and abundance of sockeye salmon into Upper Cook Inlet, Alaska, in 1997. Alaska Department of Fish and Game, Division of Commercial Fisheries, Regional Information Report 2A98-22, Anchorage.

Tarbox, K. E. 1998b. An estimate of migratory timing and abundance of sockeye salmon into Upper Cook Inlet, Alaska, in 1998. Alaska Department of Fish and Game, Commercial Fisheries Management and Development Division, Regional Information Report 2A98-30, Anchorage.

Tarbox, K. E. 1999. An estimate of migratory timing and abundance of sockeye salmon into Upper Cook Inlet, Alaska, in 1999. Alaska Department of Fish and Game, Division of Commercial Fisheries, Regional Information Report 2A99-13, Anchorage.

Tarbox, K. E., and B. King. 1992. An estimate of the migratory timing of sockeye salmon into Upper Cook Inlet, Alaska, in 1991 using a test fishery. Division of Commercial Fisheries, Regional Information Report 2A92-07, Anchorage.

Tarbox, K. E., and D. Waltemyer. 1989. An estimate of the 1988 total sockeye salmon return to Upper Cook Inlet, Alaska using a test fishery. Alaska Department of Fish and Game, Division of Commercial Fisheries, Regional Information Report 2S89-04, Anchorage.

Tobias, T. M., and K. E. Tarbox. 1999. An estimate of total return of sockeye salmon to Upper Cook Inlet, Alaska 1976-1998. Alaska Department of Fish and Game, Division of Commercial Fisheries, Regional Information Report 2A99-11, Anchorage.

Tobias, T. M., and M. Willette. 2003. An estimate of total return of sockeye salmon to Upper Cook Inlet, Alaska, 1976–2002. Alaska Department of Fish and Game, Division of Commercial Fisheries, Regional Information Report 2A03-11, Anchorage.

Tobias, T. M., and M. Willette. 2004. An estimate of the total return of sockeye salmon to upper Cook Inlet, Alaska 1976-2003. Alaska Department of Fish and Game, Division of Commercial Fisheries, Regional Information Report 2A04-11, Anchorage.

Waltemyer, D. L. 1983. Migratory timing and abundance estimation of the 1982 sockeye salmon return to Upper Cook Inlet based on a test fishing program. Alaska Department of Fish and Game, Division of Commercial Fisheries, Upper Cook Inlet Data Report 83-01, Soldotna.

Waltemyer, D. L. 1984. Describing the migrations of salmon and estimating abundance of sockeye salmon returning in 1983 to Upper Cook Inlet based on a test fishery. Alaska Department of Fish and Game, Division of Commercial Fisheries, Upper Cook Inlet Data Report 84-01, Soldotna.

Waltemyer, D. L. 1986a. Use of a test fishery to describe and estimate the sockeye salmon total return to Upper Cook Inlet in 1984. Alaska Department of Fish and Game, Division of Commercial Fisheries, Upper Cook Inlet Data Report 86-01, Soldotna.

Waltemyer, D. L. 1986b. Run strength analysis of the 1985 sockeye salmon return to Upper Cook Inlet, Alaska based on a test fishery. Alaska Department of Fish and Game, Division of Commercial Fisheries, Upper Cook Inlet Data Report 86-05, Soldotna.

Willette, T. M., W. S. Pegau, and R. D. DeCino. 2010. Monitoring dynamics of the Alaska coastal current and development of applications for management of Cook Inlet salmon – a pilot study. *Exxon Valdez* Oil Spill Gulf Ecosystem Monitoring and Research Project Final Report (GEM Project 030670), Alaska Department of Fish and Game, Division of Commercial Fisheries, Soldotna, Alaska.

TABLES AND FIGURES

Table 1.–Summary of sockeye salmon fishing effort, daily and cumulative catch and CPUE, and fish length, Upper Cook Inlet offshore test fish project, 2011.

	Number of	Mean Fishing	Catch		CPUE		Mean Length
Date	Stations	Time (min)	Daily	Cum	Daily	Cum	(mm)
1 Jul	6	221	22	22	17.7	17.7	568
2 Jul	6	219	76	98	61.6	79.3	573
3 Jul	6	222.5	71	169	56.9	136.2	561
4 Jul	6	221	16	185	12.8	149	563
5 Jul	6	222.5	24	209	19.3	168.3	582
6 Jul	6	218.5	16	225	13	181.3	565
7 Jul	6	214.5	5	230	4.1	185.4	585
8 Jul	6	212	8	238	6.8	192.2	581
9 Jul	6	216	43	281	34.4	226.6	576
10 Jul	6	253	622	903	256.6	483.2	572
11 Jul	6	232	222	1,125	158.1	641.3	574
12 Jul	6	236.5	235	1,360	172.4	813.7	572
13 Jul	6	250.5	459	1,819	312.2	1,125.9	567
14 Jul	6	243.5	380	2,199	242.7	1,368.6	577
15 Jul	6	266.5	657	2,856	378.3	1,746.9	571
16 Jul	6	259	450	3,306	290.7	2,037.6	576
17 Jul	6	217.5	194	3,500	131.1	2,168.7	576
18 Jul	6	226	137	3,637	108.7	2,277.4	575
19 Jul	6	222	47	3,684	36.1	2,313.5	576
20 Jul	6	225.5	184	3,868	134.7	2,448.2	581
21 Jul	6	226.5	71	3,939	54.2	2,502.4	579
22 Jul	6	251	392	4,331	263.4	2,765.8	575
23 Jul	6	239.5	227	4,558	161.8	2,927.6	577
24 Jul	6	226.5	231	4,789	153.1	3,080.7	574
25 Jul	6	228	155	4,944	120.5	3,201.2	575
26 Jul	6	234	184	5,128	138.2	3,339.4	573
27 Jul	6	219.5	38	5,166	29.4	3,368.8	574
28 Jul	6	232.5	195	5,361	137.7	3,506.5	569
29 Jul	6	231	209	5,570	143.1	3,649.6	570
30 Jul	6	230	90	5,660	65.5	3,715.1	569

Table 2.–Estimated sockeye salmon catch by date and station, Upper Cook Inlet offshore test fish project, 2011.

	Station Number						
Date	4	5	6	6.5	7	8	Total
1 Jul	1	2	0	8	11	0	22
2 Jul	3	26	16	17	10	4	76
3 Jul	0	10	38	18	1	4	71
4 Jul	2	6	7	0	1	0	16
5 Jul	14	4	5	0	1	0	24
6 Jul	0	2	2	3	7	2	16
7 Jul	3	0	1	1	0	0	5
8 Jul	0	5	1	1	1	0	8
9 Jul	0	27	14	2	0	0	43
10 Jul	2	612	2	5	1	0	622
11 Jul	0	10	117	11	70	14	222
12 Jul	42	56	107	2	0	28	235
13 Jul	41	29	126	50	209	4	459
14 Jul	26	5	181	11	156	1	380
15 Jul	3	37	103	347	167	0	657
16 Jul	2	46	151	138	106	7	450
17 Jul	8	9	30	44	103	0	194
18 Jul	17	24	20	16	24	36	137
19 Jul	0	0	31	1	14	1	47
20 Jul	0	2	89	24	68	1	184
21 Jul	2	38	28	1	2	0	71
22 Jul	20	56	167	63	86	0	392
23 Jul	13	111	45	54	4	0	227
24 Jul	–	2	5	142	59	17	225
25 Jul	17	19	24	38	47	10	155
26 Jul	29	4	50	38	37	26	184
27 Jul	0	1	29	0	1	7	38
28 Jul	0	0	26	105	46	18	195
29 Jul	0	3	28	30	82	66	209
30 Jul	0	0	39	33	8	10	90
Total	245	1,146	1,482	1,203	1,322	256	5,660
%	4%	20%	26%	21%	23%	5%	100%

Table 3.–Estimated sockeye salmon CPUE by date and station, Upper Cook Inlet offshore test fish project, 2011.

	Station Number						
Date	4	5	6	6.5	7	8	Total
1 Jul	0.8	1.6	0	6.6	8.7	0	17.7
2 Jul	2.5	20.0	12.6	13.1	10.2	3.2	61.6
3 Jul	0	8.2	30.4	14.2	0.8	3.3	56.9
4 Jul	1.6	4.8	5.6	0	0.8	0	12.8
5 Jul	11.1	3.3	4.1	0	0.8	0	19.3
6 Jul	0	1.6	1.7	2.5	5.6	1.6	13.0
7 Jul	2.5	0	0.8	0.8	0	0	4.1
8 Jul	0	4.2	0.9	0.9	0.8	0	6.8
9 Jul	0	21.3	11.4	1.7	0	0	34.4
10 Jul	1.6	248.1	1.7	4.3	0.9	0	256.6
11 Jul	0	8.5	80.7	9.0	48.8	11.1	158.1
12 Jul	32.3	40.5	77.3	1.6	0	20.7	172.4
13 Jul	31.5	23.8	88.2	40.0	125.4	3.3	312.2
14 Jul	20.5	4.1	109.6	9.2	98.5	0.8	242.7
15 Jul	2.4	28.8	71.8	182.6	92.7	0	378.3
16 Jul	1.8	31.0	92.4	91.9	68.3	5.3	290.7
17 Jul	6.7	7.1	22.8	30.8	63.7	0	131.1
18 Jul	13.9	19.2	15.7	12.8	18.7	28.4	108.7
19 Jul	0	0	23.3	0.8	11.2	0.8	36.1
20 Jul	0	1.7	62.8	18.9	50.4	0.9	134.7
21 Jul	1.6	29.2	21.0	0.9	1.5	0	54.2
22 Jul	16.2	42	107.7	44.9	52.6	0	263.4
23 Jul	10.7	77.4	32.1	38.6	3	0	161.8
24 Jul		1.3	4.1	88.7	40.7	13.4	153.1
25 Jul	13.6	15.2	19.2	28.9	35.3	8.3	120.5
26 Jul	23.2	3.5	38.0	27.1	26.7	19.7	138.2
27 Jul	0	0.8	22.3	0	0.8	5.5	29.4
28 Jul	0	0	18.0	73.5	32.2	14	137.7
29 Jul	0	3.9	21.5	22.0	49.7	46	143.1
30 Jul	0	0	27.9	23.3	6.5	7.8	65.5
Total	195	651	1,026	790	855	194	3,715.1
%	5%	18%	28%	21%	23%	5%	100%

Table 4.–A comparison of models used to make postseason adjustments to the offshore test fish final CPUE, 1979–2011.

	Final	Postseason OTF CPUE Adjustment		Harvest Adjusted		Total Run Adjusted	
Year	OTF CPUE	Harvest adjusted	Total Run adjusted	*a*	*b*	*a*	*b*
1979	602	651	664	-3.2451	0.1876	-3.3380	0.2004
1980	740	770	777	-2.2537	0.1640	-2.2403	0.1612
1981	364	383	387	-2.5459	0.1856	-2.5243	0.1819
1982	651	775	786	-3.6839	0.1522	-3.7156	0.1633
1983	2,464	2,472	2,474	-4.2719	0.1883	-4.2732	0.1884
1984	1,331	1,334	1,341	-3.4257	0.1855	-3.4018	0.1834
1985	1,422	1,575	1,563	-3.4581	0.1523	-3.5633	0.1626
1986	1,653	1,731	1,714	-3.7671	0.1633	-3.8642	0.1719
1987	1,404	1,422	1,428	-4.3442	0.1689	-4.6385	0.1785
1988	1,131	1,145	1,169	-3.3682	0.1639	-3.5655	0.1662
1989	619	682	692	-2.7114	0.1258	-2.7031	0.1238
1990	1,358	1,404	1,426	-5.7913	0.2259	-5.7085	0.2211
1991	1,574	1,759	1,740	-4.5806	0.1885	-4.6331	0.1919
1992	2,021	2,186	2,195	-5.4366	0.2235	-5.4043	0.2217
1993	1,815	1,882	1,913	-4.0776	0.1906	-3.9018	0.1797
1994	1,012	1,145	1,199	-4.0770	0.1553	-3.9757	0.1453
1995	1,712	1,828	1,850	-4.7036	0.2131	-4.6219	0.2078
1996	1,723	1,765	1,796	-4.6328	0.2266	-4.4605	0.2144
1997	1,656	1,705	1,826	-3.8265	0.1621	-3.7000	0.1496
1998	1,158	1,355	1,313	-3.6700	0.1473	-3.7142	0.1515
1999	2,226	2,475	2,419	-5.3100	0.2175	-5.1500	0.2081
2000	1,520	1,532	1,565	-5.1094	0.2614	-4.9141	0.2480
2001	1,586	1,594	1,630	-3.9323	0.2002	-3.9823	0.2041
2002	1,736	1,749	1,825	-4.3694	0.2292	-4.0642	0.2068
2003	1,787	1,824	1,848	-4.5091	0.2117	-4.4402	0.2068
2004	2,028	2,220	2,345	-4.6374	0.1903	-4.6374	0.1903
2005	2,643	3,032	3,191	-3.7460	0.1354	-3.7152	0.1302
2006	1,507	1,756	1,969	-4.2031	0.1438	-4.0762	0.1308
2007	2,584	2,774	2,924	-4.9217	0.1962	-4.6427	0.1793
2008	1,594	1,612	1,675	-2.9601	0.1665	-2.8021	0.1521
2009	2,487	2,559	2,616	-4.5578	0.2275	-4.4130	0.2173
2010	2,055	2,184	2,266	-3.3795	0.1702	-3.1347	0.1459
2011	3,715	3,768	3,835	-5.6748	0.2379	-5.5481	0.2304

Table 5.–Total run estimates for sockeye salmon to Upper Cook Inlet, Alaska, made during the 2011 season.

Based on data through 7/21/2011	
Escapement	1,538,881
Cumulative Catch (Commercial, Sport, & PU)	3,962,122
Residual in District	698,571
Total Run Through 7/21/2011 =	6,199,574
2011 Cumulative OTF CPUE through 7/21 =	2,502
Passage Rate (Total Run/Cumulative CPUE) through 7/21 =	2,477

Run Estimates Based on Model Results (Fit of Current Year to Past Years)

	Mean Sum	Estimated Total CPUE				Estimated
Year	of Squares	Current	Previous Day	Difference	Timing	Total Run
1990	0.001885	4,666	4,785	-119	Late 3 days	11,556,513
1992	0.001924	4,015	4,068	-54	Late 2 days	9,943,816
1999	0.002052	4,159	4,211	-52	Late 3 days	10,301,637
2006	0.002188	6,702	6,755	-54	Late 9 days	16,599,572
1987	0.002397	4,624	4,674	-50	Late 2 days	11,452,481
2007	0.00242	4,587	4,635	-49	Late 4 days	11,360,660
2004	0.003047	4,014	4,034	-20	Late 2 days	9,942,058
1991	0.003179	3,937	3,953	-16	Late 2 days	9,750,886
1994	0.003654	5,031	5,048	-17	Late 4 days	12,461,940
2005	0.004225	5,371	5,370	0	Late 7 days	13,302,718
1995	0.004870	3,361	3,345	16	On Time	8,324,432
1983	0.005883	3,510	3,492	18	On Time	8,694,538
1997	0.006823	4,115	4,094	21	Late 1 day	10,193,667
1998	0.006950	4,053	4,031	22	Late 3 days	10,038,461
2003	0.007009	3,183	3,152	31	Early 2 days	7,883,930
1996	0.008477	3,027	2,988	39	Early 2 days	7,498,416
1986	0.008664	3,492	3,460	32	Late 1 day	8,650,572
1982	0.009292	3,575	3,540	35	Late 2 days	8,854,054
2000	0.009407	2,772	2,723	48	Early 2 days	6,865,232
1993	0.009899	3,302	3,263	38	Early 1 day	8,177,920
2009	0.010284	2,928	2,882	45	Early 2 days	7,251,686
1985	0.012238	3,388	3,343	45	On Time	8,391,730
1988	0.013351	3,284	3,236	48	Early 2 days	8,134,177
2002	0.015316	2,846	2,791	55	Early 1 days	7,048,502
2001	0.016623	2,831	2,774	57	Early 2 days	7,012,710
2010	0.017888	3,349	3,290	59	On Time	8,295,724
1989	0.022877	3,479	3,407	72	On Time	8,617,654
1984	0.027443	2,758	2,689	68	Early 4 days	6,831,322
2008	0.035465	2,863	2,787	76	Early 4 days	7,091,006
1979	0.044305	2,497	2,418	79	Early 5 days	6,184,960
1980	0.087717	2,402	2,311	91	Early 9 days	5,949,823
1981	0.087910	2,336	2,246	90	Early 9 days	5,787,285

-continued-

Table 5.–Page 2 of 2.

Based on data through 7/25/2011						
Escapement						2,117,536
Cumulative Catch (Commercial, Sport, & PU)						5,074,619
Residual in District						274,230
Total Run Through 7/25/2011 =						7,466,385
2011 Cumulative OTF CPUE through 7/25 =						3,201
Passage Rate (Total Run/Cumulative CPUE) through 7/25 =						2,332
Run Estimates Based on Model Results (Fit of Current Year to Past Years)						
	Mean Sum	Estimated Total CPUE				Estimated
Year	of Squares	Current	Previous Day	Difference	Timing	Total Run
1992	0.001796	3,914	3,926	-12	Late 2 days	9,127,873
1999	0.001912	4,047	4,063	-16	Late 3 days	9,439,641
2006	0.002029	6,431	6,506	-75	Late 9 days	14,999,780
1987	0.002221	4,480	4,509	-29	Late 2 days	10,449,954
2007	0.002229	4,450	4,477	-27	Late 4 days	10,378,140
1990	0.002488	4,361	4,416	-55	Late 3 days	10,171,352
2004	0.002590	3,988	3,988	0	Late 2 days	9,302,125
1991	0.002695	3,927	3,923	4	Late 2 days	9,159,057
1994	0.003136	4,953	4,975	-21	Late 4 days	11,552,769
2005	0.003591	5,326	5,344	-18	Late 7 days	12,421,997
1995	0.004508	3,470	3,438	31	On Time	8,093,047
1983	0.005267	3,614	3,586	29	On Time	8,429,421
1997	0.005853	4,192	4,175	17	Late 1 day	9,777,532
1998	0.005978	4,135	4,116	19	Late 3 days	9,643,584
2003	0.006842	3,339	3,297	42	Early 2 days	7,786,830
1986	0.007838	3,633	3,598	35	Late 1 day	8,472,617
1982	0.008332	3,717	3,682	35	Late 2 days	8,668,373
1996	0.008711	3,213	3,165	49	Early 2 days	7,494,817
1993	0.009256	3,468	3,426	42	Early 1 day	8,089,455
2009	0.010845	3,136	3,082	54	Early 2 days	7,313,895
2000	0.011076	2,999	2,940	59	Early 2 days	6,994,197
1985	0.011265	3,568	3,525	43	On Time	8,321,992
1988	0.012474	3,477	3,431	47	Early 2 days	8,110,703
2002	0.015956	3,082	3,023	59	Early 1 days	7,188,437
2010	0.016528	3,571	3,519	52	On Time	8,328,126
2001	0.017247	3,073	3,013	60	Early 2 days	7,167,539
1989	0.020926	3,736	3,678	58	On Time	8,712,874
1984	0.027618	3,033	2,966	67	Early 4 days	7,073,101
2008	0.034185	3,152	3,084	69	Early 4 days	7,352,752
1979	0.045652	2,812	2,735	77	Early 5 days	6,558,067
1980	0.085560	2,752	2,669	84	Early 9 days	6,419,757
1981	0.087035	2,688	2,603	85	Early 9 days	6,269,203

Table 6.–Projected total Kenai River sockeye salmon run (millions) in 2011 estimated from total offshore test fish CPUE and age composition stock allocation data through 21 July and 25 July, 2011.

Data through 21 July

Year	MSS	Est. Total OTF CPUE Current	Est. Total OTF CPUE Prev. Day	Est. Total OTF CPUE Timing	Passage Rate	Estimated UCI Total run	Estimated UCI Run to Date[a]	Estimated UCI Run Remaining	Estimated Kenai Run to Date	Prop. Kenai	Estimated Kenai Run Remaining	Estimated Total Kenai Return
1990	0.00189	4,666	4,785	Late 3 days	2,477	11.56	5.40	6.16	3.655	67%	4.10	7.75
1992	0.00192	4,015	4,068	Late 2 days	2,477	9.94	5.40	4.54	3.655	67%	3.03	6.68
1999	0.00205	4,159	4,211	Late 3 days	2,477	10.30	5.40	4.90	3.655	67%	3.26	6.92
2006	0.00219	6,702	6,755	Late 9 days	2,477	16.60	5.40	11.20	3.655	67%	7.46	11.11
1987	0.00240	4,624	4,674	Late 2 days	2,477	11.45	5.40	6.05	3.655	67%	4.03	7.68

Data through 25 July

Year	MSS	Est. Total OTF CPUE Current	Est. Total OTF CPUE Prev. Day	Est. Total OTF CPUE Timing	Passage Rate	Estimated UCI Total run	Estimated UCI Run to Date[a]	Estimated UCI Run Remaining	Estimated Kenai Run to Date	Prop. Kenai	Estimated Kenai Run Remaining	Estimated Total Kenai Return
1994	0.00314	4,953	4,975	Late 4 days	2,332	11.55	7.09	4.46	4.73	67%	3.01	7.74
2005	0.00359	5,326	5,344	Late 7 days	2,332	12.42	7.09	5.33	4.73	67%	3.59	8.32
1995	0.00451	3,470	3,438	On Time	2,332	8.09	7.09	1.00	4.73	67%	0.67	5.41
1983	0.00527	3,614	3,586	On Time	2,332	8.43	7.09	1.34	4.73	67%	0.90	5.63
1997	0.00585	4,192	4,175	Late 1 day	2,332	9.78	7.09	2.69	4.73	67%	1.81	6.54

Note: MSS is the mean sum of squares.

[a] Does not include residual fish resident in the Central District.

Table 7.–Absolute percent error (APE) using the first best fit estimate of test fish data on or after July 20 to project the total annual UCI sockeye salmon run 1988–2011.

Year	Actual Run (millions)[a]	July 20 estimate	APE	Run Timing
1988	8.52	11.30	32.6%	1 day early
1990	5.00	4.90	1.9%	4 day late
1991	3.66	3.90	6.5%	2 day late
1992	10.90	11.40	4.5%	2 day late
1993	6.48	6.40	1.2%	on time
1994	5.51	5.30	3.8%	5 day late
1995	4.51	4.50	0.2%	on time
1996	5.63	8.50	51.0%	1 day early
1997	6.41	6.00	6.4%	3 day late
1998	3.00	3.40	13.3%	3 day late
1999	4.57	5.20	13.7%	3 day late
2000	2.94	3.20	8.8%	2 day early
2001	3.53	6.20	75.4%	2 day early
2002	4.84	5.50	13.6%	2 day early
2003	6.29	6.79	8.0%	1 day early
2004	7.92	8.94	12.8%	2 day late
2005	7.92	9.17	15.8%	7 day late
2006	4.96	3.60	27.5%	9 day late
2007	5.44	4.65	14.6%	4 day late
2008	4.13	5.17	25.3%	4 day early
2009	4.29	9.11	112.5%	2 day early
2010	5.26	4.69	10.8%	1 day early
2011	8.60	11.56	34.4%	2 day late

	Average	Median
All runs	22%	13%
On time +	11%	7%
All early	38%	25%

[a] Total run estimated by summing harvest and escapement throughout Upper Cook Inlet.

Table 8.–Midpoint dates of the sockeye salmon run across the Anchor Point test fish transect in Upper Cook Inlet, 1979–2011.

	Mean Date[a]	
Year	Coded	Calendar
1979	16.7	10 Jul
1980	13.9	7 Jul
1981	13.9	7 Jul
1982	22.8	16 Jul
1983	22.7	16 Jul
1984	18.5	12 Jul
1985	21.9	15 Jul
1986	22.5	15 Jul
1987	26.0	19 Jul
1988	21.5	14 Jul
1989	21.8	15 Jul
1990	25.8	19 Jul
1991	24.1	17 Jul
1992	24.4	17 Jul
1993	21.7	15 Jul
1994	27.4	20 Jul
1995	22.2	15 Jul
1996	20.8	14 Jul
1997	24.7	18 Jul
1998	24.5	18 Jul
1999	24.7	18 Jul
2000	19.8	13 Jul
2001	19.5	13 Jul
2002	19.7	13 Jul
2003	21.5	14 Jul
2004	24.4	17 Jul
2005	28.5	22 Jul
2006	31.2	24 Jul
2007	25.9	19 Jul
2008	18.4	11 Jul
2009	20.3	13 Jul
2010	21.5	14 Jul
2011	24.1	17 Jul
Average	22.3	15 Jul

[a] Day 1 = 24 June.

Table 9.–Stock composition estimates, standard deviation (SD), 90% credibility interval (CI), sample size (n), and effective sample size (n_{eff}) for mixtures of sockeye salmon captured in the Upper Cook Inlet offshore test fishery in 2006–2010.

			Reporting Group[a]							
			Crescent	West	JCL	SusYen	Fish	KTNE	Kenai	Kasilof
2006										
Start Date	07/01	Proportion	0.04	0.06	0.01	0.05	0.00	0.03	0.30	0.51
End Date	07/09	S.D.	0.01	0.02	0.01	0.02	0.00	0.01	0.04	0.04
n	325	Lower 90% CI	0.02	0.03	0.00	0.02	0.00	0.01	0.24	0.45
n_{eff}	325	Upper 90% CI	0.06	0.09	0.02	0.08	0.00	0.06	0.36	0.57
Start Date	07/10	Proportion	0.00	0.11	0.06	0.11	0.00	0.05	0.33	0.33
End Date	07/16	S.D.	0.00	0.04	0.02	0.04	0.00	0.02	0.04	0.04
n	266	Lower 90% CI	0.00	0.06	0.03	0.04	0.00	0.02	0.27	0.27
n_{eff}	263	Upper 90% CI	0.01	0.18	0.09	0.18	0.01	0.09	0.39	0.39
Start Date	07/17	Proportion	0.02	0.07	0.05	0.07	0.00	0.02	0.60	0.17
End Date	07/23	S.D.	0.01	0.02	0.02	0.02	0.00	0.01	0.03	0.03
n	401	Lower 90% CI	0.00	0.05	0.03	0.04	0.00	0.01	0.55	0.13
n_{eff}	397	Upper 90% CI	0.04	0.10	0.08	0.11	0.00	0.03	0.66	0.21
Start Date	07/24	Proportion	0.00	0.07	0.05	0.02	0.00	0.03	0.70	0.12
End Date	08/01	S.D.	0.00	0.02	0.01	0.02	0.00	0.02	0.03	0.02
n	393	Lower 90% CI	0.00	0.04	0.03	0.00	0.00	0.01	0.65	0.09
n_{eff}	391	Upper 90% CI	0.01	0.11	0.08	0.05	0.00	0.06	0.75	0.16

-continued-

Table 9.–Page 2 of 5.

			Reporting Group[a]							
			Crescent	West	JCL	SusYen	Fish	KTNE	Kenai	Kasilof
			2007							
Start Date	07/01	Proportion	0.08	0.16	0.03	0.03	0.02	0.05	0.39	0.23
End Date	07/09	S.D.	0.02	0.03	0.01	0.01	0.01	0.02	0.03	0.03
n	374	Lower 90% CI	0.05	0.11	0.02	0.01	0.00	0.02	0.34	0.19
n_{eff}	372	Upper 90% CI	0.12	0.22	0.05	0.05	0.03	0.09	0.45	0.28
Start Date	07/10	Proportion	0.03	0.08	0.05	0.10	0.01	0.03	0.53	0.17
End Date	07/13	S.D.	0.01	0.02	0.01	0.02	0.01	0.01	0.03	0.03
n	444	Lower 90% CI	0.02	0.04	0.03	0.07	0.00	0.01	0.47	0.13
n_{eff}	437	Upper 90% CI	0.06	0.11	0.07	0.14	0.02	0.05	0.59	0.22
Start Date	07/14	Proportion	0.04	0.02	0.07	0.11	0.00	0.03	0.61	0.12
End Date	07/18	S.D.	0.01	0.01	0.02	0.03	0.00	0.01	0.03	0.02
n	404	Lower 90% CI	0.02	0.01	0.05	0.06	0.00	0.01	0.56	0.08
n_{eff}	399	Upper 90% CI	0.06	0.05	0.10	0.15	0.00	0.05	0.66	0.16
Start Date	07/19	Proportion	0.05	0.02	0.04	0.08	0.00	0.03	0.67	0.10
End Date	07/23	S.D.	0.01	0.01	0.01	0.02	0.00	0.01	0.03	0.02
n	429	Lower 90% CI	0.04	0.01	0.03	0.05	0.00	0.02	0.62	0.06
n_{eff}	427	Upper 90% CI	0.08	0.04	0.07	0.11	0.00	0.05	0.72	0.13
Start Date	07/24	Proportion	0.05	0.04	0.05	0.06	0.00	0.02	0.69	0.09
End Date	08/02	S.D.	0.02	0.01	0.01	0.02	0.00	0.01	0.03	0.02
n	438	Lower 90% CI	0.03	0.02	0.03	0.03	0.00	0.00	0.64	0.06
n_{eff}	434	Upper 90% CI	0.08	0.06	0.08	0.09	0.00	0.04	0.74	0.13

-continued-

Table 9.–Page 3 of 5.

			Reporting Group[a]							
			Crescent	West	JCL	SusYen	Fish	KTNE	Kenai	Kasilof
						2008				
Start Date	07/01	Proportion	0.03	0.11	0.05	0.04	0.01	0.03	0.27	0.45
End Date	07/07	S.D.	0.01	0.02	0.01	0.02	0.01	0.01	0.03	0.03
n	422	Lower 90% CI	0.02	0.07	0.04	0.02	0.00	0.02	0.22	0.40
n_{eff}	418	Upper 90% CI	0.05	0.15	0.08	0.08	0.03	0.05	0.32	0.50
Start Date	07/08	Proportion	0.04	0.12	0.07	0.10	0.00	0.01	0.43	0.22
End Date	07/12	S.D.	0.01	0.02	0.01	0.02	0.00	0.01	0.03	0.02
n	465	Lower 90% CI	0.02	0.09	0.05	0.07	0.00	0.00	0.39	0.18
n_{eff}	457	Upper 90% CI	0.06	0.16	0.10	0.14	0.00	0.02	0.48	0.26
Start Date	07/13	Proportion	0.05	0.13	0.10	0.05	0.00	0.03	0.49	0.15
End Date	07/17	S.D.	0.01	0.02	0.02	0.02	0.00	0.01	0.03	0.02
n	436	Lower 90% CI	0.03	0.09	0.07	0.01	0.00	0.01	0.44	0.11
n_{eff}	429	Upper 90% CI	0.07	0.16	0.14	0.09	0.00	0.05	0.54	0.19
Start Date	07/18	Proportion	0.03	0.13	0.06	0.04	0.00	0.02	0.58	0.14
End Date	07/31	S.D.	0.01	0.02	0.01	0.01	0.00	0.01	0.03	0.02
n	438	Lower 90% CI	0.01	0.10	0.04	0.02	0.00	0.01	0.54	0.11
n_{eff}	426	Upper 90% CI	0.05	0.16	0.08	0.06	0.00	0.03	0.63	0.18

-continued-

Table 9.–Page 4 of 5.

			Reporting Group[a]							
			Crescent	West	JCL	SusYen	Fish	KTNE	Kenai	Kasilof
			2009							
Start Date	07/01	Proportion	0.02	0.24	0.02	0.00	0.03	0.04	0.33	0.31
End Date	07/05	S.D.	0.01	0.03	0.01	0.00	0.01	0.01	0.03	0.03
n	401	Lower 90% CI	0.00	0.20	0.01	0.00	0.02	0.02	0.28	0.26
neff	392	Upper 90% CI	0.04	0.28	0.04	0.01	0.05	0.06	0.38	0.36
Start Date	07/06	Proportion	0.04	0.18	0.03	0.09	0.01	0.04	0.33	0.28
End Date	07/09	S.D.	0.01	0.03	0.02	0.03	0.01	0.01	0.03	0.03
n	445	Lower 90% CI	0.02	0.13	0.00	0.05	0.02	0.02	0.28	0.23
neff	431	Upper 90% CI	0.07	0.22	0.06	0.14	0.06	0.06	0.38	0.33
Start Date	07/10	Proportion	0.07	0.20	0.05	0.09	0.01	0.03	0.48	0.07
End Date	07/13	S.D.	0.02	0.03	0.02	0.03	0.01	0.01	0.03	0.02
n	407	Lower 90% CI	0.04	0.15	0.03	0.04	0.01	0.01	0.43	0.04
neff	398	Upper 90% CI	0.10	0.25	0.08	0.14	0.05	0.05	0.53	0.10
Start Date	07/14	Proportion	0.07	0.13	0.03	0.06	0.01	0.02	0.63	0.05
End Date	07/16	S.D.	0.02	0.02	0.01	0.02	0.01	0.01	0.03	0.02
n	406	Lower 90% CI	0.04	0.09	0.01	0.04	0.00	0.01	0.58	0.03
neff	395	Upper 90% CI	0.10	0.16	0.05	0.09	0.03	0.03	0.68	0.08
Start Date	07/17	Proportion	0.07	0.10	0.02	0.07	0.01	0.02	0.67	0.04
End Date	07/22	S.D.	0.02	0.03	0.01	0.03	0.01	0.01	0.03	0.02
n	402	Lower 90% CI	0.05	0.06	0.01	0.02	0.00	0.01	0.62	0.01
neff	397	Upper 90% CI	0.10	0.15	0.04	0.11	0.02	0.04	0.72	0.07
Start Date	07/23	Proportion	0.05	0.12	0.04	0.02	0.00	0.03	0.72	0.01
End Date	07/30	S.D.	0.02	0.02	0.01	0.01	0.00	0.01	0.03	0.02
n	331	Lower 90% CI	0.03	0.09	0.02	0.01	0.00	0.01	0.67	0.00
neff	324	Upper 90% CI	0.08	0.16	0.06	0.05	0.00	0.05	0.77	0.04

-continued-

Table 9.–Page 5 of 5.

			Reporting Group[a]							
			Crescent	West	JCL	SusYen	Fish	KTNE	Kenai	Kasilof
			2010							
Start Date	07/01	Proportion	0.05	0.16	0.03	0.03	0.09	0.05	0.46	0.14
End Date	07/04	SD	0.01	0.02	0.01	0.01	0.02	0.01	0.03	0.02
n	358	Lower 90% CI	0.03	0.11	0.01	0.01	0.07	0.03	0.41	0.11
n_{eff}	357	Upper 90% CI	0.07	0.20	0.04	0.06	0.12	0.07	0.51	0.17
Start Date	07/05	Proportion	0.02	0.17	0.04	0.05	0.06	0.05	0.50	0.12
End Date	07/10	SD	0.01	0.02	0.01	0.01	0.01	0.01	0.02	0.02
n	464	Lower 90% CI	0.01	0.14	0.02	0.03	0.04	0.03	0.45	0.09
n_{eff}	464	Upper 90% CI	0.03	0.21	0.05	0.07	0.08	0.07	0.54	0.15
Start Date	07/11	Proportion	0.03	0.13	0.03	0.04	0.01	0.04	0.68	0.05
End Date	07/16	SD	0.01	0.02	0.01	0.01	0.01	0.01	0.02	0.01
n	448	Lower 90% CI	0.02	0.10	0.02	0.02	0.01	0.02	0.64	0.03
n_{eff}	448	Upper 90% CI	0.04	0.16	0.04	0.05	0.03	0.05	0.72	0.07
Start Date	07/17	Proportion	0.04	0.12	0.05	0.03	0.00	0.03	0.71	0.02
End Date	07/23	SD	0.01	0.02	0.01	0.01	0.00	0.01	0.02	0.01
n	390	Lower 90% CI	0.02	0.10	0.03	0.02	0.00	0.01	0.67	0.01
n_{eff}	389	Upper 90% CI	0.06	0.15	0.07	0.05	0.00	0.04	0.75	0.04
Start Date	07/24	Proportion	0.03	0.11	0.02	0.02	0.00	0.01	0.78	0.03
End Date	07/29	SD	0.01	0.02	0.01	0.01	0.00	0.01	0.02	0.01
n	426	Lower 90% CI	0.02	0.09	0.01	0.01	0.00	0.00	0.74	0.01
n_{eff}	426	Upper 90% CI	0.05	0.14	0.03	0.03	0.01	0.02	0.81	0.04

Source: Reproduced from Barclay et al. 2010a, 2010b, and *In prep*.

Note: Effective sample size (n_{eff}) is number of samples successfully screened from each stratum after excluding individuals with <80% scorable markers (see text). Proportions for a given mixture may not sum to 1 due to rounding error.

[a] Crescent = largest producer on the west side of Cook Inlet; West = the remaining West Cook Inlet producers; JCL= the lakes with weirs in the Susitna/Yentna rivers (Judd/Chelatna/Larson); SusYen = the remaining producers in the Susitna/Yentna rivers; Fish = the only major creek with a weir in the Knik/Turnagain/Northeast Cook Inlet area; KTNE = the remaining Knik/Turnagain/Northeast Cook Inlet producers; Kenai = the composite of all populations within the Kenai River; Kasilof = the composite of all populations within the Kasilof River.

Table 10.–Stock composition estimates, standard deviation (SD), and 90% credibility interval (CI), and effective sample size (n_{eff}) for spatially grouped mixtures of sockeye salmon captured in the Cook Inlet offshore test fishery by station from 1 to 30 July, 2010.

		Reporting Group							
		Crescent	West	JCL	SusYen	Fish	KTNE	Kenai	Kasilof
Station 4	Proportion	0.05	0.10	0.04	0.04	0.04	0.03	0.63	0.07
n_{eff} = 222	SD	0.02	0.02	0.01	0.02	0.01	0.01	0.03	0.02
	Lower 90% CI	0.03	0.06	0.02	0.02	0.02	0.01	0.58	0.04
	Upper 90% CI	0.08	0.14	0.06	0.07	0.06	0.06	0.69	0.10
Station 5	Proportion	0.02	0.10	0.02	0.04	0.02	0.04	0.69	0.07
n_{eff} = 296	SD	0.01	0.02	0.01	0.01	0.01	0.01	0.03	0.02
	Lower 90% CI	0.01	0.07	0.01	0.02	0.01	0.02	0.64	0.05
	Upper 90% CI	0.03	0.14	0.03	0.06	0.04	0.06	0.74	0.10
Station 6	Proportion	0.02	0.13	0.04	0.04	0.05	0.03	0.63	0.06
n_{eff} = 486	SD	0.01	0.02	0.01	0.01	0.01	0.01	0.02	0.01
	Lower 90% CI	0.01	0.11	0.03	0.02	0.03	0.02	0.59	0.04
	Upper 90% CI	0.03	0.16	0.06	0.06	0.07	0.05	0.66	0.08
Station 6.5	Proportion	0.01	0.15	0.04	0.04	0.04	0.03	0.64	0.06
n_{eff} = 528	SD	0.01	0.02	0.01	0.01	0.01	0.01	0.02	0.01
	Lower 90% CI	0.00	0.12	0.03	0.02	0.02	0.02	0.60	0.04
	Upper 90% CI	0.02	0.18	0.06	0.05	0.05	0.04	0.67	0.08
Station 7	Proportion	0.05	0.15	0.02	0.04	0.02	0.03	0.60	0.08
n_{eff} = 380	SD	0.01	0.02	0.01	0.01	0.01	0.01	0.03	0.02
	Lower 90% CI	0.03	0.12	0.01	0.02	0.01	0.02	0.56	0.06
	Upper 90% CI	0.07	0.19	0.04	0.05	0.04	0.05	0.65	0.11
Station 8	Proportion	0.09	0.15	0.01	0.01	0.03	0.05	0.58	0.06
n_{eff} = 172	SD	0.02	0.03	0.01	0.01	0.01	0.02	0.04	0.02
	Lower 90% CI	0.05	0.10	0.00	0.00	0.01	0.02	0.52	0.03
	Upper 90% CI	0.13	0.21	0.03	0.04	0.06	0.09	0.65	0.10

Source: Andy Barclay, Genetics Fisheries Biologist, ADF&G, Anchorage.

Note: Effective sample size (n_{eff}) is the number of samples successfully screened from each stratum after excluding individuals with <80% scorable markers. Proportions for a given mixture may not sum to 1 due to rounding error.

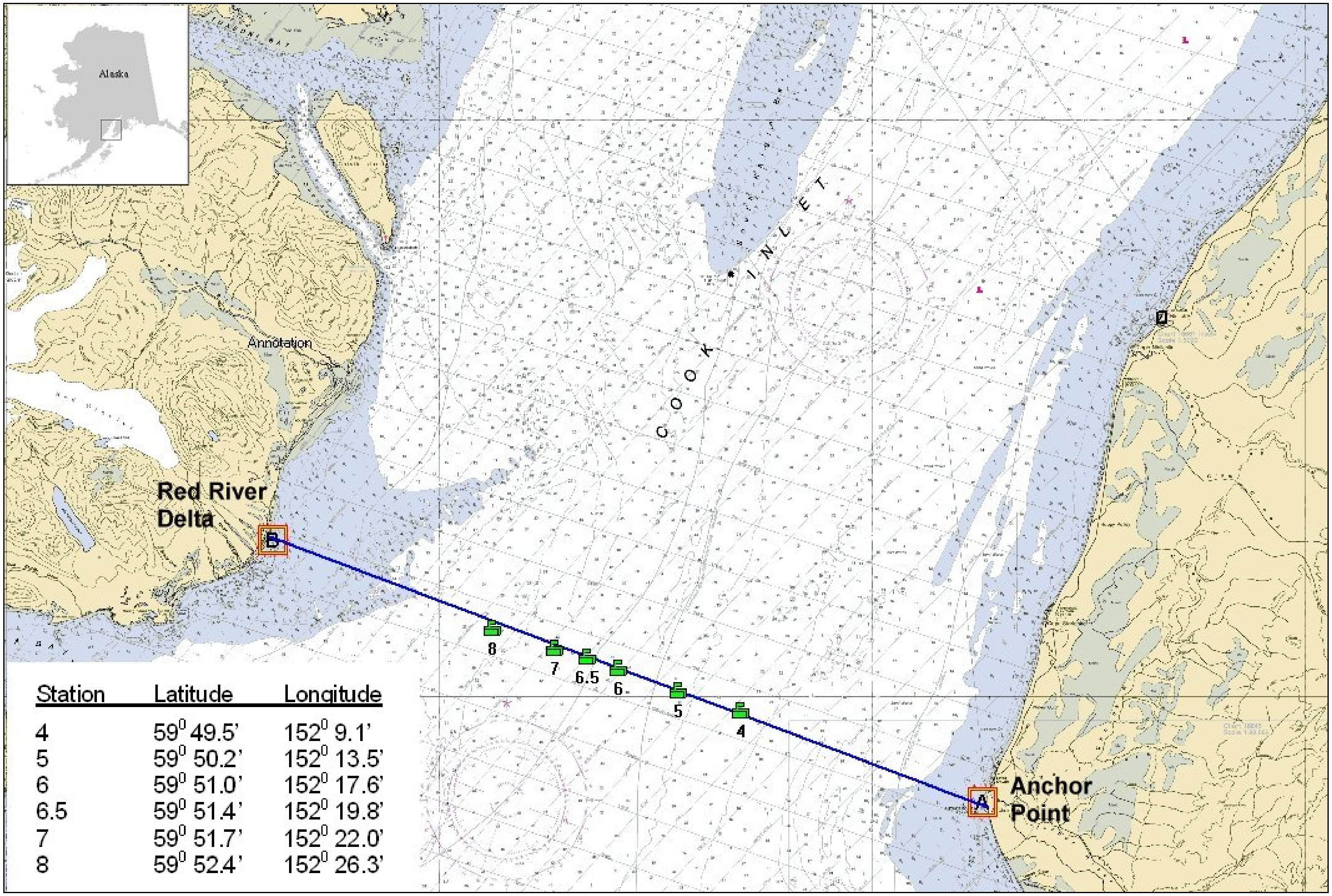

Figure 1.–Location of offshore test fish transect and fishing stations in Cook Inlet, Alaska, 2011.

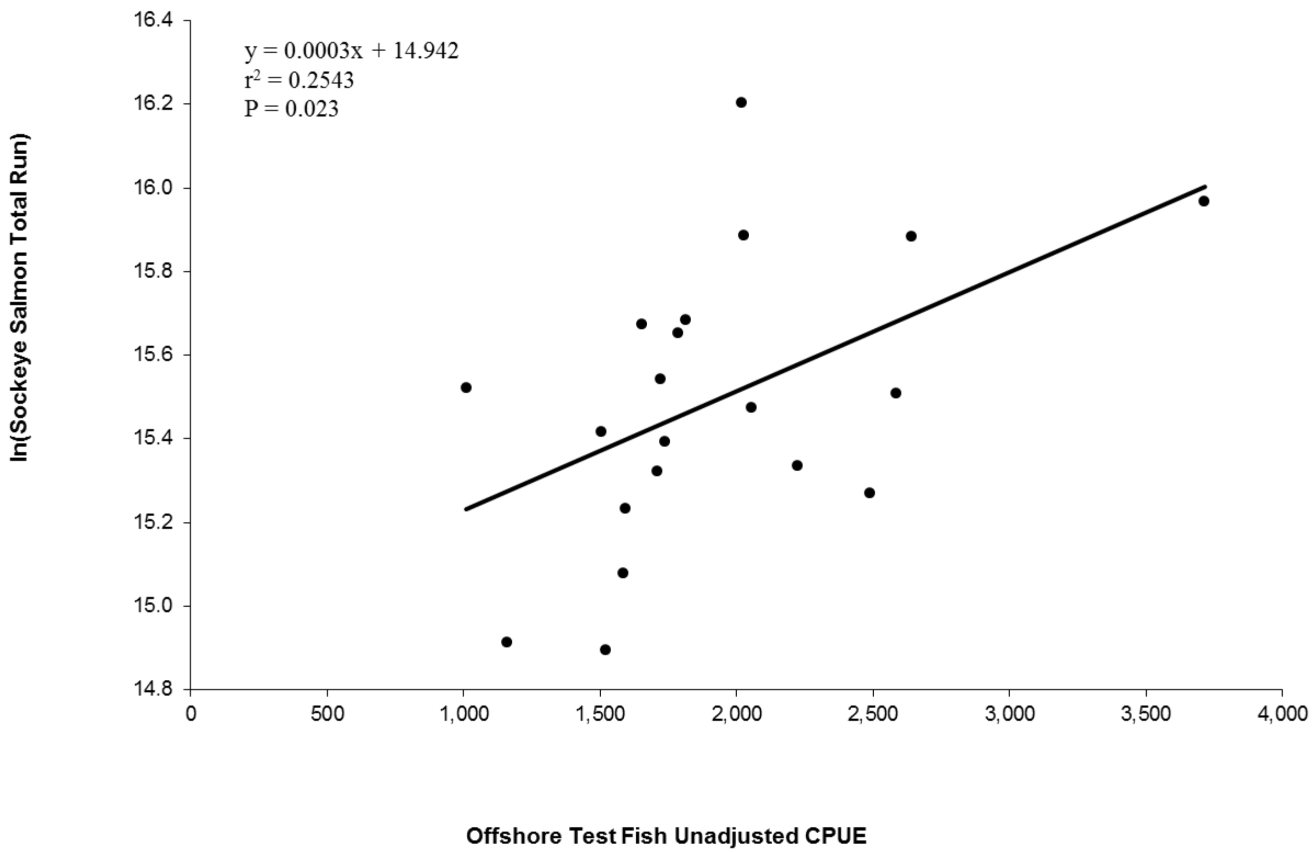

Figure 2.–Linear regression of the relationship between offshore test fish unadjusted cumulative CPUE and Upper Cook Inlet logged sockeye salmon total annual run, 1992–2011.

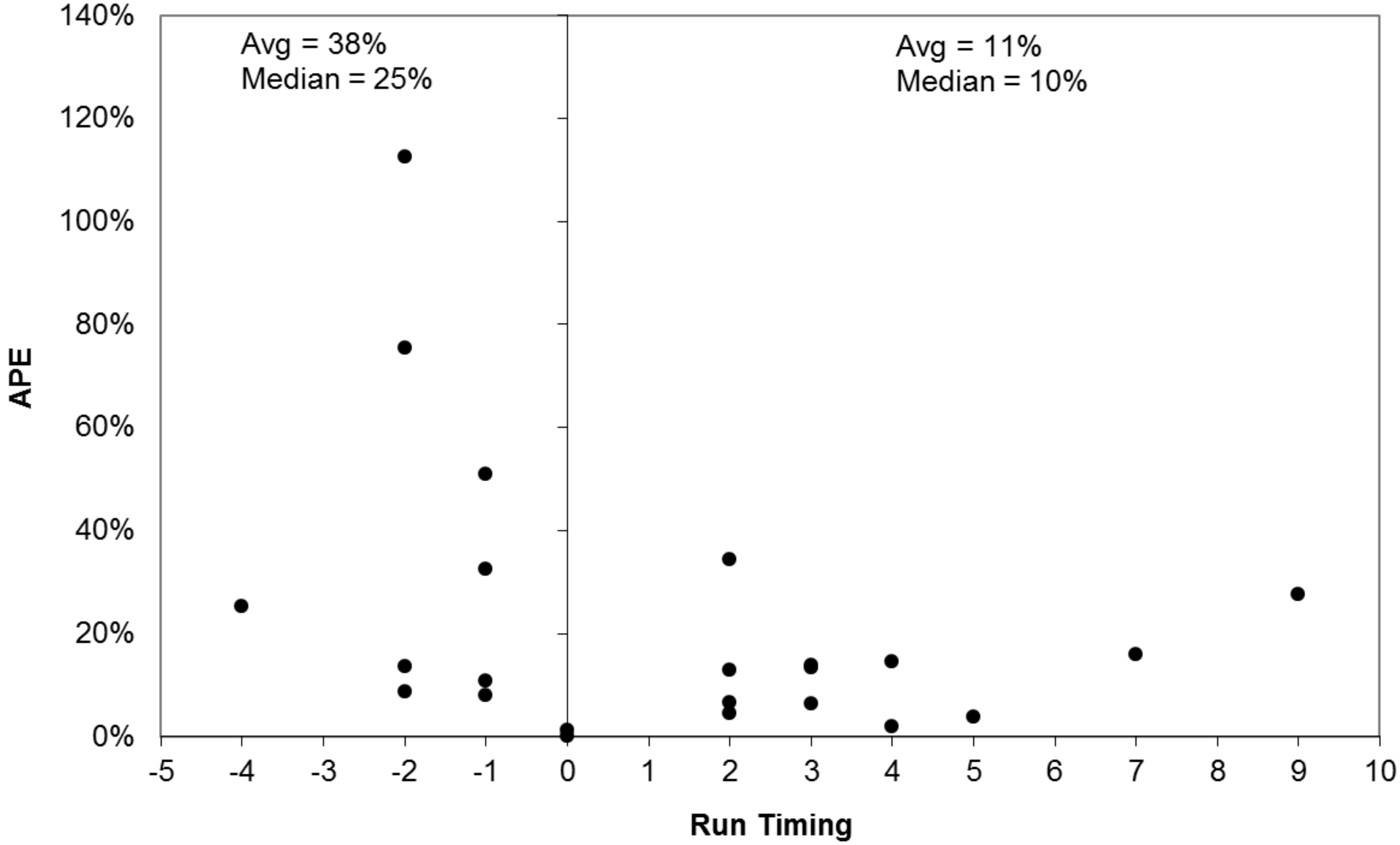

Figure 3.–Absolute percentage error (APE) in forecasting the total sockeye salmon run to Upper Cook Inlet using the 20 July best fit estimate, 1988–2011.

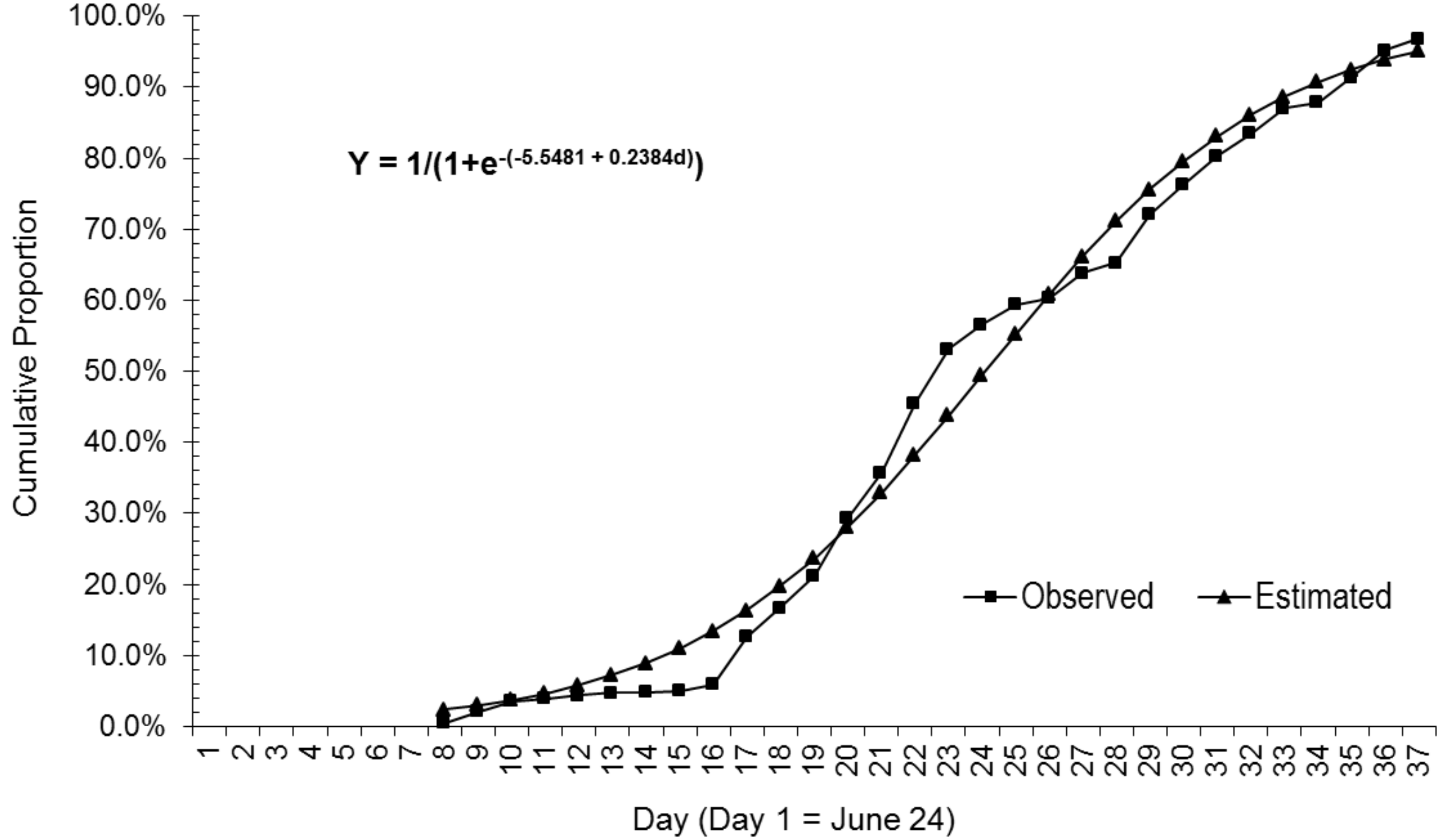

Figure 4.–Cumulative proportions estimated for the sockeye salmon run to Upper Cook Inlet, Alaska, 2011.

APPENDIX A

Appendix A1.–Summary of pink salmon fishing effort, daily and cumulative catch, and daily and cumulative CPUE, Upper Cook Inlet offshore test fish project, 2011.

Date	Number of Stations	Mean Fishing Time (min)	Catch		CPUE	
			Daily	Cum	Daily	Cum
1 Jul	6	221.0	0	0	0	0
2 Jul	6	219.0	2	2	2	2
3 Jul	6	222.5	1	3	1	2
4 Jul	6	221.0	0	3	0	2
5 Jul	6	222.5	0	3	0	2
6 Jul	6	218.5	0	3	0	2
7 Jul	6	214.5	0	3	0	2
8 Jul	6	212.0	0	3	0	2
9 Jul	6	216.0	1	4	1	3
10 Jul	6	253.0	1	5	1	4
11 Jul	6	232.0	3	8	2	6
12 Jul	6	236.5	4	12	3	9
13 Jul	6	250.5	5	17	3	13
14 Jul	6	243.5	4	21	3	15
15 Jul	6	266.5	4	25	2	17
16 Jul	6	259.0	5	30	3	21
17 Jul	6	217.5	1	31	1	21
18 Jul	6	226.0	0	31	0	21
19 Jul	6	222.0	0	31	0	21
20 Jul	6	225.5	1	32	1	22
21 Jul	6	226.5	0	32	0	22
22 Jul	6	251.0	7	39	5	27
23 Jul	6	239.5	2	41	1	28
24 Jul	6	226.5	5	46	4	32
25 Jul	6	228.0	2	48	2	33
26 Jul	6	234.0	6	54	5	38
27 Jul	6	219.5	7	61	6	44
28 Jul	6	232.5	9	70	6	50
29 Jul	6	231.0	9	79	6	56
30 Jul	6	230.0	11	90	8	64

Appendix A2.–Estimated pink salmon catch by date and station, Upper Cook Inlet offshore test fish project, 2011.

	Station Number						
Date	4	5	6	6.5	7	8	Total
1 Jul	0	0	0	0	0	0	0
2 Jul	0	0	2	0	0	0	2
3 Jul	0	1	0	0	0	0	1
4 Jul	0	0	0	0	0	0	0
5 Jul	0	0	0	0	0	0	0
6 Jul	0	0	0	0	0	0	0
7 Jul	0	0	0	0	0	0	0
8 Jul	0	0	0	0	0	0	0
9 Jul	0	0	0	0	1	0	1
10 Jul	1	0	0	0	0	0	1
11 Jul	0	1	1	0	1	0	3
12 Jul	0	0	4	0	0	0	4
13 Jul	1	0	2	1	1	0	5
14 Jul	0	0	3	1	0	0	4
15 Jul	0	0	1	3	0	0	4
16 Jul	0	1	2	0	2	0	5
17 Jul	0	0	0	1	0	0	1
18 Jul	0	0	0	0	0	0	0
19 Jul	0	0	0	0	0	0	0
20 Jul	0	0	1	0	0	0	1
21 Jul	0	0	0	0	0	0	0
22 Jul	0	1	1	4	1	0	7
23 Jul	0	1	0	1	0	0	2
24 Jul	0	0	0	2	2	0	5
25 Jul	0	1	1	0	0	0	2
26 Jul	0	1	2	2	0	1	6
27 Jul	0	1	2	2	1	1	7
28 Jul	0	0	2	3	3	1	9
29 Jul	0	0	3	2	4	0	9
30 Jul	0	0	7	3	0	1	11
Total	2	8	34	25	16	4	90
%	2%	9%	38%	28%	18%	4%	100%

Appendix A3.–Estimated pink salmon CPUE by date and station, Upper Cook Inlet offshore test fish project 2011.

	Station Number						
Date	4	5	6	6.5	7	8	Total
1 Jul	0	0	0	0	0	0	0
2 Jul	0	0	1.6	0	0	0	1.6
3 Jul	0	0.8	0	0	0	0	0.8
4 Jul	0	0	0	0	0	0	0
5 Jul	0	0	0	0	0	0	0
6 Jul	0	0	0	0	0	0	0
7 Jul	0	0	0	0	0	0	0
8 Jul	0	0	0	0	0	0	0
9 Jul	0	0	0	0	0.9	0	0.9
10 Jul	0.8	0	0	0	0	0	0.8
11 Jul	0	0.8	0.7	0	0.7	0	2.2
12 Jul	0	0	2.9	0	0	0	2.9
13 Jul	0.7	0	1.3	0.8	0.6	0	3.4
14 Jul	0	0	1.8	0.8	0	0	2.6
15 Jul	0	0	0.7	1.5	0	0	2.2
16 Jul	0	0.7	1.2	0	1.3	0	3.2
17 Jul	0	0	0	0.7	0	0	0.7
18 Jul	0	0	0	0	0	0	0
19 Jul	0	0	0	0	0	0	0
20 Jul	0	0	0.7	0	0	0	0.7
21 Jul	0	0	0	0	0	0	0
22 Jul	0	0.8	0.6	2.8	0.6	0	4.8
23 Jul	0	0.7	0	0.7	0	0	1.4
24 Jul	0	0	0	1.3	1.4	0	3.5
25 Jul	0	0.8	0.8	0	0	0	1.6
26 Jul	0	0.9	1.5	1.4	0	0.8	4.6
27 Jul	0	0.8	1.5	1.7	0.8	0.8	5.6
28 Jul	0	0	1.4	2.1	2.1	0.8	6.4
29 Jul	0	0	2.3	1.5	2.4	0	6.2
30 Jul	0	0	4.9	2.1	0	0.8	7.8
Total	2	6	24	17	11	3	64
Percent	2%	10%	37%	27%	17%	5%	100%

Appendix A4.–Summary of chum salmon fishing effort, daily and cumulative catch, and daily and cumulative CPUE, Upper Cook Inlet offshore test fish project, 2011.

	Number of	Mean Fishing	Catch		CPUE	
Date	Stations	Time (min)	Daily	Cum	Daily	Cum
1 Jul	6	221.0	2	2	2	2
2 Jul	6	219.0	4	6	3	5
3 Jul	6	222.5	6	12	5	10
4 Jul	6	221.0	0	12	0	10
5 Jul	6	222.5	3	15	2	12
6 Jul	6	218.5	4	19	3	15
7 Jul	6	214.5	3	22	3	18
8 Jul	6	212.0	0	22	0	18
9 Jul	6	216.0	2	24	2	20
10 Jul	6	253.0	13	37	10	30
11 Jul	6	232.0	5	42	4	33
12 Jul	6	236.5	33	75	24	57
13 Jul	6	250.5	12	87	7	65
14 Jul	6	243.5	45	132	30	94
15 Jul	6	266.5	75	207	42	136
16 Jul	6	259.0	47	254	30	166
17 Jul	6	217.5	32	286	22	188
18 Jul	6	226.0	20	306	16	204
19 Jul	6	222.0	10	316	8	212
20 Jul	6	225.5	14	330	10	222
21 Jul	6	226.5	29	359	22	245
22 Jul	6	251.0	61	420	40	285
23 Jul	6	239.5	33	453	24	309
24 Jul	6	226.5	94	547	64	372
25 Jul	6	228.0	25	572	19	392
26 Jul	6	234.0	29	601	21	413
27 Jul	6	219.5	13	614	10	423
28 Jul	6	232.5	51	665	37	460
29 Jul	6	231.0	42	707	28	488
30 Jul	6	230.0	61	768	44	532

Appendix A5.–Estimated chum salmon catch by date and station, Upper Cook Inlet offshore test fish project, 2011.

	Station Number						
Date	4	5	6	6.5	7	8	Total
1 Jul	0	1	0	1	0	0	2
2 Jul	1	1	1	0	1	0	4
3 Jul	0	1	4	1	0	0	6
4 Jul	0	0	0	0	0	0	0
5 Jul	0	1	2	0	0	0	3
6 Jul	0	1	1	0	1	1	4
7 Jul	0	0	1	2	0	0	3
8 Jul	0	0	0	0	0	0	0
9 Jul	0	0	0	2	0	0	2
10 Jul	1	2	5	3	2	0	13
11 Jul	0	0	0	1	4	0	5
12 Jul	1	0	30	1	1	0	33
13 Jul	1	0	0	1	10	0	12
14 Jul	1	0	35	9	0	0	45
15 Jul	1	5	3	44	22	0	75
16 Jul	0	1	25	10	9	2	47
17 Jul	0	5	8	5	14	0	32
18 Jul	1	3	10	4	2	0	20
19 Jul	0	0	8	0	2	0	10
20 Jul	0	1	7	5	1	0	14
21 Jul	2	8	15	1	2	1	29
22 Jul	0	6	20	11	24	0	61
23 Jul	0	2	11	12	6	2	33
24 Jul	0	0	0	37	43	12	94
25 Jul	4	3	4	6	8	0	25
26 Jul	3	2	1	12	11	0	29
27 Jul	1	1	5	0	3	3	13
28 Jul	0	0	3	30	15	3	51
29 Jul	0	0	2	8	19	13	42
30 Jul	0	0	19	28	9	5	61
Total	17	44	220	234	209	42	768
Percent	2%	6%	29%	30%	27%	5%	100%

Appendix A6.–Estimated chum salmon CPUE by date and station, Upper Cook Inlet offshore test fish project, 2011.

	Station Number						
Date	4	5	6	6.5	7	8	Total
1 Jul	0.0	0.8	0.0	0.8	0.0	0.0	1.6
2 Jul	0.8	0.8	0.8	0.0	1.0	0.0	3.4
3 Jul	0.0	0.8	3.2	0.8	0.0	0.0	4.8
4 Jul	0.0	0.0	0.0	0.0	0.0	0.0	0.0
5 Jul	0.0	0.8	1.6	0.0	0.0	0.0	2.4
6 Jul	0.0	0.8	0.8	0.0	0.8	0.8	3.2
7 Jul	0.0	0.0	0.8	1.7	0.0	0.0	2.5
8 Jul	0.0	0.0	0.0	0.0	0.0	0.0	0.0
9 Jul	0.0	0.0	0.0	1.7	0.0	0.0	1.7
10 Jul	0.8	0.8	4.2	2.6	1.7	0.0	10.1
11 Jul	0.0	0.0	0.0	0.8	2.7	0.0	3.5
12 Jul	0.8	0.0	21.7	0.8	0.8	0.0	24.1
13 Jul	0.7	0.0	0.0	0.8	5.8	0.0	7.3
14 Jul	0.8	0.0	21.2	7.5	0.0	0.0	29.5
15 Jul	0.8	3.8	2.1	23.2	12.2	0.0	42.1
16 Jul	0.0	0.7	15.3	6.7	5.8	1.5	30.0
17 Jul	0.0	3.9	6.1	3.5	8.7	0.0	22.2
18 Jul	0.8	2.4	7.9	3.2	1.6	0.0	15.9
19 Jul	0.0	0.0	6.0	0.0	1.6	0.0	7.6
20 Jul	0.0	0.9	4.9	3.9	0.7	0.0	10.4
21 Jul	1.6	6.2	11.3	0.9	1.5	0.9	22.4
22 Jul	0.0	4.5	12.9	7.8	14.7	0.0	39.9
23 Jul	0.0	1.4	7.9	8.5	4.6	1.6	24.0
24 Jul	0.0	0.0	0.0	23.1	29.7	9.4	63.8
25 Jul	3.2	2.4	3.2	4.6	6.0	0.0	19.4
26 Jul	2.4	1.7	0.8	8.6	7.8	0.0	21.3
27 Jul	0.8	0.8	3.8	0.0	2.5	2.4	10.3
28 Jul	0.0	0.0	2.1	21.0	11.2	2.3	36.6
29 Jul	0.0	0.0	1.5	5.9	11.7	9.1	28.2
30 Jul	0.0	0.0	13.3	19.6	7.3	3.9	44.1
Total	14	34	153	158	140	32	532
Percent	3%	6%	29%	30%	26%	6%	100%

Appendix A7.–Summary of coho salmon fishing effort, daily and cumulative catch, and daily and cumulative CPUE, Upper Cook Inlet offshore test fish project, 2011.

	Number of	Mean Fishing	Catch		CPUE	
Date	Stations	Time (min)	Daily	Cum	Daily	Cum
1 Jul	6	221.0	1	1	1	1
2 Jul	6	219.0	1	2	1	2
3 Jul	6	222.5	1	3	1	2
4 Jul	6	221.0	0	3	0	2
5 Jul	6	222.5	1	4	1	3
6 Jul	6	218.5	0	4	0	3
7 Jul	6	214.5	0	4	0	3
8 Jul	6	212.0	0	4	0	3
9 Jul	6	216.0	1	5	1	4
10 Jul	6	253.0	0	5	0	4
11 Jul	6	232.0	5	10	4	8
12 Jul	6	236.5	12	22	9	16
13 Jul	6	250.5	12	34	7	24
14 Jul	6	243.5	10	44	8	32
15 Jul	6	266.5	21	65	11	43
16 Jul	6	259.0	16	81	11	53
17 Jul	6	217.5	10	91	7	61
18 Jul	6	226.0	14	105	11	72
19 Jul	6	222.0	2	107	2	73
20 Jul	6	225.5	9	116	7	80
21 Jul	6	226.5	6	122	5	85
22 Jul	6	251.0	33	155	22	106
23 Jul	6	239.5	30	185	22	128
24 Jul	6	226.5	32	217	22	150
25 Jul	6	228.0	24	241	19	169
26 Jul	6	234.0	29	270	22	191
27 Jul	6	219.5	8	278	7	197
28 Jul	6	232.5	21	299	15	212
29 Jul	6	231.0	38	337	26	238
30 Jul	6	230.0	37	374	27	264

Appendix A8.–Estimated coho salmon catch by date and station, Upper Cook Inlet offshore test fish project, 2011.

	Station Number						
Date	4	5	6	6.5	7	8	Total
1 Jul	0	0	1	0	0	0	1
2 Jul	0	1	0	0	0	0	1
3 Jul	0	0	1	0	0	0	1
4 Jul	0	0	0	0	0	0	0
5 Jul	0	0	1	0	0	0	1
6 Jul	0	0	0	0	0	0	0
7 Jul	0	0	0	0	0	0	0
8 Jul	0	0	0	0	0	0	0
9 Jul	0	0	0	0	0	1	1
10 Jul	0	0	0	0	0	0	0
11 Jul	0	1	0	0	4	0	5
12 Jul	1	1	9	0	1	0	12
13 Jul	0	0	1	1	10	0	12
14 Jul	1	0	2	5	2	0	10
15 Jul	0	0	1	18	2	0	21
16 Jul	0	2	1	9	4	0	16
17 Jul	2	1	1	1	5	0	10
18 Jul	0	1	10	0	3	0	14
19 Jul	0	0	2	0	0	0	2
20 Jul	0	1	4	2	2	0	9
21 Jul	0	5	0	0	0	1	6
22 Jul	2	2	1	6	22	0	33
23 Jul	0	0	13	9	7	1	30
24 Jul	0	0	1	7	19	5	32
25 Jul	2	1	4	6	8	3	24
26 Jul	0	1	0	8	18	2	29
27 Jul	0	1	3	1	2	1	8
28 Jul	0	0	0	6	13	2	21
29 Jul	0	0	2	6	13	17	38
30 Jul	0	0	14	16	4	3	37
Total	8	18	72	101	139	36	374
Percent	2%	5%	19%	27%	37%	10%	100%

Appendix A9.–Estimated coho salmon CPUE by date and station, Upper Cook Inlet offshore test fish project, 2011.

	Station Number						
Date	4	5	6	6.5	7	8	Total
1 Jul	0.0	0.0	0.8	0.0	0.0	0.0	0.8
2 Jul	0.0	0.8	0.0	0.0	0.0	0.0	0.8
3 Jul	0.0	0.0	0.8	0.0	0.0	0.0	0.8
4 Jul	0.0	0.0	0.0	0.0	0.0	0.0	0.0
5 Jul	0.0	0.0	0.8	0.0	0.0	0.0	0.8
6 Jul	0.0	0.0	0.0	0.0	0.0	0.0	0.0
7 Jul	0.0	0.0	0.0	0.0	0.0	0.0	0.0
8 Jul	0.0	0.0	0.0	0.0	0.0	0.0	0.0
9 Jul	0.0	0.0	0.0	0.0	0.0	0.9	0.9
10 Jul	0.0	0.0	0.0	0.0	0.0	0.0	0.0
11 Jul	0.0	0.8	0.0	0.0	2.7	0.0	3.5
12 Jul	0.8	0.7	6.5	0.0	0.8	0.0	8.8
13 Jul	0.0	0.0	0.7	0.8	5.8	0.0	7.3
14 Jul	0.8	0.0	1.6	4.2	1.3	0.0	7.9
15 Jul	0.0	0.0	0.7	9.5	1.1	0.0	11.3
16 Jul	0.0	1.3	0.6	6.0	2.6	0.0	10.5
17 Jul	1.7	0.8	0.8	0.7	3.1	0.0	7.1
18 Jul	0.0	0.8	7.9	0.0	2.3	0.0	11.0
19 Jul	0.0	0.0	1.5	0.0	0.0	0.0	1.5
20 Jul	0.0	0.9	2.8	1.6	1.5	0.0	6.8
21 Jul	0.0	3.8	0.0	0.0	0.0	0.9	4.7
22 Jul	1.6	1.5	0.6	4.3	13.5	0.0	21.5
23 Jul	0.0	0.0	9.3	6.4	5.3	0.8	21.8
24 Jul	0.0	0.0	0.8	4.4	13.1	3.9	22.2
25 Jul	1.6	0.8	3.2	4.6	6.0	2.5	18.7
26 Jul	0.0	0.9	0.0	5.7	13.0	2.3	21.9
27 Jul	0.0	0.8	2.3	0.9	1.7	0.8	6.5
28 Jul	0.0	0.0	0.0	4.2	9.1	1.6	14.9
29 Jul	0.0	0.0	1.5	4.4	7.8	11.9	25.6
30 Jul	0.0	0.0	9.8	11.2	3.2	2.3	26.5
Total	7	14	53	69	94	28	264
Percent	2%	5%	20%	26%	36%	11%	100%

Appendix A10.–Summary of Chinook salmon fishing effort, daily and cumulative catch, and daily and cumulative CPUE, Upper Cook Inlet offshore test fish project, 2011.

	Number of	Mean Fishing	Catch		CPUE	
Date	Stations	Time (min)	Daily	Cum	Daily	Cum
1 Jul	6	221.0	1	1	1	1
2 Jul	6	219.0	0	1	0	1
3 Jul	6	222.5	1	2	1	2
4 Jul	6	221.0	0	2	0	2
5 Jul	6	222.5	0	2	0	2
6 Jul	6	218.5	0	2	0	2
7 Jul	6	214.5	0	2	0	2
8 Jul	6	212.0	0	2	0	2
9 Jul	6	216.0	0	2	0	2
10 Jul	6	253.0	0	2	0	2
11 Jul	6	232.0	1	3	1	2
12 Jul	6	236.5	0	3	0	2
13 Jul	6	250.5	0	3	0	2
14 Jul	6	243.5	0	3	0	2
15 Jul	6	266.5	0	3	0	2
16 Jul	6	259.0	2	5	1	4
17 Jul	6	217.5	1	6	1	4
18 Jul	6	226.0	0	6	0	4
19 Jul	6	222.0	0	6	0	4
20 Jul	6	225.5	0	6	0	4
21 Jul	6	226.5	0	6	0	4
22 Jul	6	251.0	0	6	0	4
23 Jul	6	239.5	1	7	1	5
24 Jul	6	226.5	0	7	0	5
25 Jul	6	228.0	0	7	0	5
26 Jul	6	234.0	0	7	0	5
27 Jul	6	219.5	0	7	0	5
28 Jul	6	232.5	0	7	0	5
29 Jul	6	231.0	0	7	0	5
30 Jul	6	230.0	0	7	0	5

Appendix A11.–Estimated Chinook salmon catch by date and station, Upper Cook Inlet offshore test fish project, 2011.

	Station Number						
Date	4	5	6	6.5	7	8	Total
1 Jul	0	1	0	0	0	0	1
2 Jul	0	0	0	0	0	0	0
3 Jul	0	0	0	1	0	0	1
4 Jul	0	0	0	0	0	0	0
5 Jul	0	0	0	0	0	0	0
6 Jul	0	0	0	0	0	0	0
7 Jul	0	0	0	0	0	0	0
8 Jul	0	0	0	0	0	0	0
9 Jul	0	0	0	0	0	0	0
10 Jul	0	0	0	0	0	0	0
11 July	0	0	0	0	1	0	1
12 Jul	0	0	0	0	0	0	0
13 Jul	0	0	0	0	0	0	0
14 Jul	0	0	0	0	0	0	0
15 Jul	0	0	0	0	0	0	0
16 Jul	0	1	0	0	1	0	2
17 Jul	0	0	0	0	1	0	1
18 Jul	0	0	0	0	0	0	0
19 Jul	0	0	0	0	0	0	0
20 Jul	0	0	0	0	0	0	0
21 Jul	0	0	0	0	0	0	0
22 Jul	0	0	0	0	0	0	0
23 Jul	0	0	0	1	0	0	1
24 Jul	0	0	0	0	0	0	0
25 Jul	0	0	0	0	0	0	0
26 Jul	0	0	0	0	0	0	0
27 Jul	0	0	0	0	0	0	0
28 Jul	0	0	0	0	0	0	0
29 Jul	0	0	0	0	0	0	0
30 Jul	0	0	0	0	0	0	0
Total	0	2	0	2	3	0	7
Percent	0%	29%	0%	29%	43%	0%	100%

Appendix A12.–Estimated Chinook salmon CPUE by date and station, Upper Cook Inlet offshore test fish project, 2011.

	Station Number						
Date	4	5	6	6.5	7	8	Total
1 Jul	0.0	0.8	0.0	0.0	0.0	0.0	0.8
2 Jul	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3 Jul	0.0	0.0	0.0	0.8	0.0	0.0	0.8
4 Jul	0.0	0.0	0.0	0.0	0.0	0.0	0.0
5 Jul	0.0	0.0	0.0	0.0	0.0	0.0	0.0
6 Jul	0.0	0.0	0.0	0.0	0.0	0.0	0.0
7 Jul	0.0	0.0	0.0	0.0	0.0	0.0	0.0
8 Jul	0.0	0.0	0.0	0.0	0.0	0.0	0.0
9 Jul	0.0	0.0	0.0	0.0	0.0	0.0	0.0
10 Jul	0.0	0.0	0.0	0.0	0.0	0.0	0.0
11 Jul	0.0	0.0	0.0	0.0	0.7	0.0	0.7
12 Jul	0.0	0.0	0.0	0.0	0.0	0.0	0.0
13 Jul	0.0	0.0	0.0	0.0	0.0	0.0	0.0
14 Jul	0.0	0.0	0.0	0.0	0.0	0.0	0.0
15 Jul	0.0	0.0	0.0	0.0	0.0	0.0	0.0
16 Jul	0.0	0.7	0.0	0.0	0.6	0.0	1.3
17 Jul	0.0	0.0	0.0	0.0	0.6	0.0	0.6
18 Jul	0.0	0.0	0.0	0.0	0.0	0.0	0.0
19 Jul	0.0	0.0	0.0	0.0	0.0	0.0	0.0
20 Jul	0.0	0.0	0.0	0.0	0.0	0.0	0.0
21 Jul	0.0	0.0	0.0	0.0	0.0	0.0	0.0
22 Jul	0.0	0.0	0.0	0.0	0.0	0.0	0.0
23 Jul	0.0	0.0	0.0	0.7	0.0	0.0	0.7
24 Jul	0.0	0.0	0.0	0.0	0.0	0.0	0.0
25 Jul	0.0	0.0	0.0	0.0	0.0	0.0	0.0
26 Jul	0.0	0.0	0.0	0.0	0.0	0.0	0.0
27 Jul	0.0	0.0	0.0	0.0	0.0	0.0	0.0
28 Jul	0.0	0.0	0.0	0.0	0.0	0.0	0.0
29 Jul	0.0	0.0	0.0	0.0	0.0	0.0	0.0
30 Jul	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total	0	2	0	1.5	1.9	8.0	5
Percent	0%	31%	0%	31%	39%	163%	100%

Appendix A13.–Final cumulative catch and CPUE values by year for pink, chum, coho, and Chinook salmon from the Upper Cook Inlet offshore test fish project, 1992–2011.

	Pink		Chum		Coho		Chinook	
Year	Catch	CPUE	Catch	CPUE	Catch	CPUE	Catch	CPUE
1992	326	226.6	667	443.1	444	299.4	3	2.5
1993	53	44.6	205	153.0	325	257.7	5	3.8
1994	227	166.4	521	345.0	752	513.1	1	0.8
1995	155	97.3	1,129	687.0	941	595.4	3	2.3
1996	119	84.3	491	319.4	758	533.8	3	2.3
1997	203	157.7	420	305.7	502	374.8	4	3.2
1998	556	406.2	438	311.9	547	403.4	3	2.4
1999	31	23.1	451	330.6	404	307.2	7	5.6
2000	908	607.5	1,031	671.9	1157	766.3	2	1.4
2001	283	228.9	933	655.2	1209	838.4	11	8.4
2002	809	571.5	1,537	1012.6	1184	797.8	6	4.3
2003	182	125.8	1,000	713.2	506	367.7	13	10.0
2004	650	438.9	652	447.0	1119	785.4	4	3.1
2005	186	150.0	448	300.0	546	344.0	8	5.6
2006	1,023	655.0	988	635.0	1613	1,037.0	12	8.0
2007	348	247.0	398	265.0	692	482.0	5	4.0
2008	306	226.0	405	273.0	1024	718.0	3	2.0
2009	701	526.0	454	303.0	512	361.0	11	8.0
2010	266	176.0	1,155	736.0	700	454.0	3	2.0
1992–2010 Avg	386	271.5	701	468.8	786	538.8	6	4.2
2011	90	64.0	768	532.0	374	264.0	7	5.0

Appendix A14.–Entry pattern of sockeye salmon into Upper Cook Inlet, Alaska, 2011 estimated from daily CPUE measured at the latitude of Anchor Point.

Day	Date	Input y	Estimated y	Residual	Change in Input Y	Change in Estimated Y
8	1 Jul	0.0046	0.024	-0.0194		
9	2 Jul	0.0207	0.03	-0.0094	0.0161	0.006
10	3 Jul	0.0355	0.0375	-0.002	0.0148	0.0075
11	4 Jul	0.0389	0.0468	-0.0079	0.0033	0.0093
12	5 Jul	0.0439	0.0582	-0.0143	0.005	0.0114
13	6 Jul	0.0473	0.0722	-0.0249	0.0034	0.014
14	7 Jul	0.0483	0.0892	-0.0409	0.0011	0.017
15	8 Jul	0.0501	0.1098	-0.0597	0.0018	0.0206
16	9 Jul	0.0591	0.1344	-0.0754	0.009	0.0246
17	10 Jul	0.126	0.1636	-0.0376	0.0669	0.0291
18	11 Jul	0.1672	0.1976	-0.0304	0.0412	0.034
19	12 Jul	0.2122	0.2367	-0.0245	0.045	0.0391
20	13 Jul	0.2936	0.2808	0.0128	0.0814	0.0441
21	14 Jul	0.3569	0.3295	0.0273	0.0633	0.0488
22	15 Jul	0.4555	0.3823	0.0733	0.0986	0.0527
23	16 Jul	0.5313	0.4379	0.0934	0.0758	0.0557
24	17 Jul	0.5655	0.4952	0.0703	0.0342	0.0573
25	18 Jul	0.5938	0.5526	0.0413	0.0283	0.0574
26	19 Jul	0.6033	0.6086	-0.0054	0.0094	0.056
27	20 Jul	0.6384	0.6619	-0.0235	0.0351	0.0533
28	21 Jul	0.6525	0.7114	-0.0589	0.0141	0.0495
29	22 Jul	0.7212	0.7563	-0.0351	0.0687	0.0449
30	23 Jul	0.7634	0.7962	-0.0329	0.0422	0.0399
31	24 Jul	0.8033	0.8311	-0.0278	0.0399	0.0348
32	25 Jul	0.8347	0.861	-0.0263	0.0314	0.0299
33	26 Jul	0.8708	0.8864	-0.0156	0.036	0.0253
34	27 Jul	0.8784	0.9076	-0.0291	0.0077	0.0212
35	28 Jul	0.9143	0.9252	-0.0108	0.0359	0.0176
36	29 Jul	0.9517	0.9396	0.012	0.0373	0.0145
37	30 Jul	0.9687	0.9515	0.0173	0.0171	0.0118

Appendix A15.–Chemical and physical observations made in Upper Cook Inlet, Alaska, during the 2011 offshore test fish project.

Date	Sta	Air Temp (c)	Water Temp (c)	Wind Vel. (knots)	Wind Dir	Tide Stage	Salinity (ppt)	Water Depth (f)	Secchi (m)
1 Jul	4	10	8.5	4	southwest	flood	31.5	25.4	5.0
	5	11	9.0	4	southwest	flood	31.5	38.1	5.5
	6	10	8.9	5	southwest	flood	31.4	47.9	5.0
	6.5	11	8.1	5	southwest	flood	31.4	44.0	6.0
	7	10	8.8	6	south	flood	30.7	47.0	5.0
	8	11	9.0	9	south	low	31.4	28.0	4.0
2 Jul	8	10	8.5	7	southeast	flood	30.9	31.5	4.0
	7	10	8.5	6	southeast	high	30.6	42.6	4.0
	6.5	10	8.7	6	southeast	ebb	30.1	44.2	5.0
	6	9	9.1	5	southeast	ebb	31.2	43.7	5.0
	5	11	8.5	4	south	ebb	31.0	36.0	5.0
	4	12	8.6	2	south	ebb	31.3	23.5	5.5
3 Jul	4	9	7.8	6	south	ebb	31.6	22.9	10.0
	5	12	7.9	9	south	ebb	31.6	38.4	12.5
	6	10	9.1	7	south	ebb	33.3	46.5	5.0
	6.5	12	9.5	8	south	ebb	30.1	42.0	2.0
	7	10	9.1	8	south	flood	30.3	45.0	2.0
	8	11	9.7	8	southwest	flood	29.9	26.0	3.0
4 Jul	8	12	8.9	2	southwest	flood	30.6	32.1	3.0
	7	10	8.8	3	southwest	flood	30.4	46.0	5.5
	6.5	10	8.4	2	southwest	high	31.0	44.0	6.5
	6	12	8.2	2	southwest	ebb	31.1	48.0	6.0
	5	10	8.0	2	southwest	ebb	31.2	33.4	6.5
	4	9	7.9	3	southwest	ebb	31.6	23.8	9.5
5 Jul	4	11	8.3	2	southwest	ebb	31.3	24.0	7.5
	5	15	9.5	0	southwest	ebb	30.4	35.0	6.0
	6	16	9.9	2	north	ebb	30.1	46.0	3.5
	6.5	9	10.4	3	north	ebb	29.9	40.0	3.0
	7	12	9.7	1	north	ebb	30.1	44.0	2.5
	8	13	9.6	2	southwest	ebb	29.8	26.0	1.5
6 Jul	8	10	9.3	7	southwest	flood	30.2	28.0	3.0
	7	10	9.3	10	southwest	flood	31.1	46.0	4.0
	6.5	10	8.9	6	southwest	flood	30.8	40.0	5.0
	6	11	8.7	3	southwest	high	31.0	48.6	6.0
	5	10	8.8	5	southwest	ebb	31.1	32.3	5.5
	4	10	8.4	6	southwest	ebb	31.2	23.0	6.0

-continued-

Appendix A15.–Page 2 of 5.

Date	Sta	Air Temp (c)	Water Temp (c)	Wind Vel. (knots)	Wind Dir	Tide Stage	Salinity (ppt)	Water Depth (f)	Secchi (m)
7 Jul	4	10	8.1	2	northwest	flood	31.9	23.0	8.5
	5	11	8.3	1	west	high	31.4	38.0	6
	6	11	8.7	1	west	ebb	31	49.0	4.5
	6.5	11	9.5	2	northwest	ebb	30.5	43.0	3.5
	7	15	9.6	0	west	ebb	30.2	45.0	3.5
	8	15	9.6	0	na	ebb	30.2	26.0	3.5
8 Jul	8	11	9.6	3	southwest	flood	30.2	29.0	1.5
	7	11	9.6	3	southwest	flood	30.2	45.5	3.0
	6.5	13	9.5	1	northeast	flood	30.3	45.0	3.5
	6	10	8.3	2	south	flood	31.3	49.0	6.0
	5	10	8.5	2	south	flood	31.6	37.0	8.5
	4	10	8.4	4	southwest	ebb	31.6	24.0	8.5
9 Jul	4	10	8.5	4	northwest	flood	31.7	25.0	7.5
	5	10	8.1	3	northwest	high	31.5	37.0	6.0
	6	10	8.9	2	north	ebb	31.2	47.0	6.0
	6.5	11	9.7	2	north	ebb	30.4	43.0	4.0
	7	11	10.1	2	north	ebb	31.1	45.0	4.0
	8	17	9.7	1	east	ebb	30.2	28.0	4.0
10 Jul	8	10	9.7	1	southwest	ebb	30.2	29.4	3.0
	7	14	10.2	0	na	ebb	29.5	44.0	3.0
	6.5	11	10.1	2	northwest	low	29.5	42.0	4.0
	6	13	9.9	1	north	flood	30.1	49.4	4.0
	5	12	9.0	2	north	flood	31.1	40.0	6.0
	4	10	8.2	2	southwest	flood	31.5	26.0	9.5
11 Jul	4	10	9.2	5	north	flood	31.4	24.0	7.0
	5	10	8.8	4	north	flood	31.3	38.0	8.0
	6	11	8.7	2	north	flood	31.4	48.0	7.0
	6.5	11	10.3	3	north	high	29.6	44.0	4.0
	7	11	10.3	3	north	high	29.6	46.0	4.0
	8	11	10.5	3	north	ebb	30.2	30.0	3.0
12 Jul	8	11	10.3	3	southwest	ebb	29.3	29.4	3.0
	7	11	10.2	5	southwest	ebb	29.6	44.0	3.5
	6.5	11	10.1	7	southwest	ebb	29.6	43.0	4.0
	6	11	10.3	6	south	ebb	29.2	47.0	4.0
	5	10	8.9	9	south	flood	31.2	36.0	5.0
	4	10	8.8	7	south	flood	31.4	24.0	7.0

-continued-

Appendix A15.–Page 3 of 5.

Date	Sta	Air Temp (c)	Water Temp (c)	Wind Vel. (knots)	Wind Dir	Tide Stage	Salinity (ppt)	Water Depth (f)	Secchi (m)
13 Jul	4	10	8.9	4	southeast	ebb	31.5	22.0	6.0
	5	13	9.3	2	southeast	low	30.6	48.0	4.0
	6	15	9.7	0	southwest	flood	30.6	45.0	5.0
	6.5	13	10.1	2	southwest	flood	30.1	43.0	6.0
	7	11	10.8	3	southwest	flood	29.9	36.6	5.0
	8	16	9.7	2	southeast	flood	30.3	31.0	3.0
14 Jul	8	15	9.8	0	north	high	30.2	32.0	4.0
	7	12	9.8	2	southwest	ebb	30.1	46.0	4.0
	6.5	11	9.9	3	southwest	ebb	29.9	42.0	3.0
	6	11	9.7	3	south	ebb	30.1	46.0	5.0
	5	12	9.1	1	south	low	31.2	35.0	5.0
	4	13	9.3	5	southwest	flood	31.3	23.0	5.5
15 Jul	4	10	8.9	6	south	ebb	31.5	22.0	5.0
	5	11	9.0	2	southeast	low	31.2	35.0	5.0
	6	14	9.5	1	southeast	flood	30.7	46.0	4.0
	6.5	10	10.3	3	southeast	flood	30.2	42.0	5.0
	7	11	10.2	2	southeast	flood	30.7	46.0	4.0
	8	12	10.0	0	southeast	flood	30.5	30.0	4.0
16 Jul	8	11	9.4	5	southwest	high	30.7	32.0	4.0
	7	11	9.4	7	southwest	ebb	30.7	46.0	4.0
	6.5	12	9.8	6	southwest	ebb	30.3	43.0	4.5
	6	11	10.2	5	south	ebb	30.0	46.0	3.5
	5	11	9.1	5	southwest	low	31.1	36.0	6.0
	4	13	9.2	2	southwest	flood	31.6	23.0	7.0
17 Jul	4	10	8.2	9	south	low	31.8	24.0	6.5
	5	10	9.1	4	south	flood	31.4	37.0	6.0
	6	10	9.1	8	south	flood	31.2	49.0	5.0
	6.5	10	9.0	7	southwest	flood	30.1	44.0	4.5
	7	10	9.7	11	southwest	flood	30.5	47.0	4.0
	8	10	9.8	12	southwest	flood	30.6	25.0	3.0
18 Jul	8	11	9.8	4	southwest	flood	30.4	32.0	2.8
	7	11	9.5	5	southwest	high	30.6	45.0	4.0
	6.5	11	9.7	4	southwest	ebb	30.5	42.0	4.0
	6	12	9.9	4	southwest	ebb	30.4	47.0	4.0
	5	11	9.6	6	east	ebb	30.8	32.0	5.0
	4	10	8.1	7	southwest	ebb	32.0	22.0	8.0

-continued-

Appendix A15.–Page 4 of 5.

Date	Sta	Air Temp (c)	Water Temp (c)	Wind Vel. (knots)	Wind Dir	Tide Stage	Salinity (ppt)	Water Depth (f)	Secchi (m)
19 Jul	4	11	9.3	1	northwest	ebb	31.4	23.0	6.5
	5	17	10.0	0	na	ebb	30.7	35.0	6.0
	6	13	10.3	1	northwest	ebb	30.2	45.0	4.0
	6.5	12	10.5	3	northwest	low	30.0	42.0	3.0
	7	11	13.9	2	northwest	low	29.4	45.0	4.0
	8	14	10.5	3	southwest	flood	30.1	29.0	3.0
20 Jul	8	14	10.3	1	northwest	flood	30.1	32.0	3.0
	7	13	9.9	1	northwest	flood	30.5	45.0	4.0
	6.5	12	9.2	1	north	flood	31.2	44.0	5.5
	6	12	8.9	1	northwest	high	31.4	49.0	7.0
	5	13	9.2	1	northwest	ebb	31.5	33.0	7.0
	4	13	9.0	0	na	ebb	31.6	23.0	10.0
21 Jul	4	11	8.7	1	southeast	high	31.6	25.0	8.0
	5	12	8.7	0	na	ebb	31.6	34.0	5.0
	6	10	10.5	3	southwest	ebb	30.2	6.0	4.0
	6.5	11	10.8	2	southwest	ebb	30.0	41.0	3.5
	7	12	10.8	3	southwest	ebb	30.1	45.0	3.5
	8	12	10.5	2	southwest	low	30.3	26.0	3.0
22 Jul	8	12	11.3	3	south	flood	29.1	31.0	3.0
	7	11	11.4	4	south	flood	29.0	46.0	3.5
	6.5	11	11.4	5	south	flood	29.2	43.0	4.0
	6	13	9.0	3	south	flood	31.5	49.0	8.0
	5	12	8.8	4	south	flood	31.7	37.0	8.5
	4	11	8.9	5	south	high	31.8	24.0	10.0
23 Jul	4	12	8.9	2	south	flood	31.8	22.0	10.5
	5	13	10.6	2	south	flood	30.5	32.0	9.0
	6	12	10.9	3	southeast	flood	29.9	38.0	4.0
	6.5	12	11.3	3	southwest	ebb	29.4	39.0	3.5
	7	12	9.7	4	southwest	ebb	29.9	40.0	4.0
	8	12	10.7	5	southwest	ebb	30.0	29.0	3.0
24 Jul	8	11	11.5	6	south	ebb	28.8	31.0	3.5
	7	10	11.3	5	south	low	29.2	46.0	3.0
	6.5	11	10.8	4	southwest	low	29.8	39.0	4.0
	6	11	10.2	2	southwest	flood	30.5	50.0	4.5
	5	11	8.9	4	west	flood	31.7	33.0	9.0
	4	11	8.8	1	southwest	flood	31.7	26.0	11.0

-continued-

Appendix A15.–Page 5 of 5.

Date	Sta	Air Temp (c)	Water Temp (c)	Wind Vel. (knots)	Wind Dir	Tide Stage	Salinity (ppt)	Water Depth (f)	Secchi (m)
25 Jul	4	12	10.2	3	southwest	flood	30.4	25.0	5.0
	5	13	11.4	5	southwest	flood	29.7	38.0	5.0
	6	14	11.9	3	southwest	high	28.5	49.0	3.5
	6.5	13	12.4	4	southwest	high	28.2	42.0	3.0
	7	13	12.7	2	southwest	ebb	28.2	46.0	3.0
	8	13	12.6	3	north	ebb	28.2	27.0	4.0
26 Jul	8	11	12.1	6	south	ebb	28.2	32.0	3.5
	7	12	12.0	5	southwest	ebb	28.2	42.0	3.5
	6.5	11	12.0	5	southwest	ebb	28.1	42.0	4.0
	6	12	11.4	4	southwest	ebb	29.1	49.0	4.0
	5	11	11.3	1	south	ebb	29.4	37.0	5.0
	4	11	9.6	2	north	flood	31.4	25.0	9.0
27 Jul	4	11	9.3	5	north	low	31.4	26.0	9.0
	5	11	9.7	5	north	low	31.2	37.0	5.0
	6	12	10.4	4	north	flood	30.6	48.0	6.0
	6.5	14	12.2	3	north	flood	27.5	43.0	3.5
	7	13	12.6	4	north	flood	27.1	46.0	3.5
	8		12.0	6	north	flood	28.4	28.0	3.0
28 Jul	8	11	11.7	7	southeast	ebb	28.7	32.0	3.0
	7	11	11.3	7	southeast	ebb	28.8	44.0	4.0
	6.5	11	11.0	10	southeast	ebb	28.9	44.0	3.5
	6	10	11.8	6	southeast	ebb	29.8	45.0	5.5
	5	12	9.8	29	southeast	high	31.1	35.0	8.0
	4	11	9.5	5	southeast	flood	31.5	25.0	9.0
29 Jul	4	12	9.8	2	southeast	ebb	30.8	25.0	8.0
	5	12	9.9	1	southeast	ebb	31.3	36.0	7.0
	6	12	9.8	1	southeast	flood	30.9	47.0	7.0
	6.5	12	10.0	21	southeast	flood	30.5	42.0	6.0
	7	12	12.4	1	southeast	flood	28.3	47.0	4.5
	8	12	12.3	1	southeast	flood	28.4	32.0	3.0
30 Jul	8	14	11.3	2	south	high	29.1	33.0	3.0
	7	13	10.9	3	northwest	ebb	29.1	45.0	4.0
	6.5	11	11.0	3	south	ebb	29.1	45.0	6.0
	6	12	10.9	6	southeast	ebb	29.2	48.0	4.0
	5	12	10.3	3	southeast	ebb	30.1	32.0	6.0
	4	12	9.2	4	southeast	low	31.6	23.0	6.0
Averages		11.5	9.8	3.9	south	ebb	30.4	37.1	5.1
Min		9.0	7.8	0.0	na	na	27.1	6.0	1.5
Max		17.0	13.9	29.0	na	na	33.3	50.0	12.5

Appendix A16.–Yearly mean values of physical observations made during the conduct of the 2001–2011 offshore test fish project.

Sta	Year	Air Temp (c)	Water Temp (c)	Wind Vel. (knots)	Wind Dir	Salinity (ppt)	Water Depth (f)	Secchi (m)
4	2001	12.9	9.8	11.1	SE	31.5	23.6	8.4
	2002	12.6	9.5	12.6	S	31.4	23.6	8.1
	2003	14.1	10.6	12.0	S	31.2	23.4	8.3
	2004	10.7	9.6	7.1	E	31.3	23.8	7.9
	2005	12.9	10.9	6.2	S	31.0	24.5	7.4
	2006	11.1	9.9	6.0	SE	30.7	23.9	7.7
	2007	10.8	8.6	4.7	SE	31.2	23.9	8.1
	2008	11.0	9.3	8.0	SE	30.6	22.8	8.5
	2009	11.0	9.1	6.2	SE	33.3	24.4	7.3
	2010	10.7	9.6	5.9	S	31.2	24.1	7.6
	2011	10.8	8.8	3.7	S	31.5	23.9	7.7
	Avg	11.7	9.6	7.6	SE	31.4	23.8	7.9
5	2001	12.9	10.1	11.2	SE	31.0	35.5	6.9
	2002	12.8	9.7	13.9	S	30.9	35.8	6.3
	2003	14.0	11.0	13.3	SE	30.6	35.7	6.3
	2004	10.7	9.9	7.2	SE	30.7	34.7	7.1
	2005	13.1	11.1	5.9	S	30.6	36.3	6.5
	2006	11.1	10.2	7.6	S	30.2	35.4	5.6
	2007	10.8	8.7	4.6	S	30.9	35.4	7.2
	2008	10.4	8.8	6.7	SE	30.4	35.4	6.4
	2009	11.1	9.6	6.6	SE	32.4	35.9	5.8
	2010	11.0	9.5	5.5	SE	30.8	35.3	6.7
	2011	11.6	9.2	4.0	S	31.1	36.0	6.4
	Avg	11.8	9.8	7.9	SE	30.9	35.6	6.5
6	2001	12.8	10.7	10.7	S	30.5	46.2	5.2
	2002	12.8	10.1	13.4	S	30.4	45.1	4.2
	2003	14.7	11.5	12.9	S	29.5	46.4	4.9
	2004	10.6	10.3	8.0	SE	30.1	46.6	4.6
	2005	12.8	11.6	8.0	S	29.4	45.8	4.7
	2006	12.8	11.6	8.0	S	29.8	45.8	4.7
	2007	11.0	9.5	6.0	S	30.0	47.2	4.8
	2008	10.4	9.3	6.2	S	29.5	47.3	5.0
	2009	11.5	10.2	6.0	SE	31.3	46.7	4.0
	2010	11.2	9.9	6.1	S	30.1	46.6	4.7
	2011	11.7	9.8	3.2	S	30.6	45.7	5.0
	Avg	12.0	10.4	8.1	S	30.1	46.3	4.7
6.5	2001	12.8	11.1	11.8	S	29.4	42.7	4.0
	2002	12.6	10.4	13.7	S	30.0	42.6	3.3
	2003	14.4	11.7	14.9	S	29.1	41.3	4.1
	2004	10.7	10.8	10.1	SE	29.4	41.6	3.6
	2005	13.2	12.2	7.4	S	28.7	42.8	4.2
	2006	11.2	10.3	8.5	SE	29.7	41.6	3.4
	2007	11.1	9.7	6.2	S	29.8	42.9	4.3
	2008	10.4	9.6	6.3	S	29.2	42.3	4.4
	2009	11.8	10.4	6.4	S	31.0	42.5	3.7
	2010	11.2	10.1	6.2	S	29.7	41.7	3.7
	2011	11.3	10.2	4.5	S	29.9	42.5	4.2
	Avg	11.9	10.6	8.7	S	29.6	42.2	3.9

-continued-

Appendix A16.–Page 2 of 2.

Sta	Year	Air Temp (c)	Water Temp (c)	Wind Vel. (knots)	Wind Dir	Salinity (ppt)	Water Depth (f)	Secchi (m)
7	2001	13.1	11.4	9.9	SE	29.0	43.6	3.5
	2002	12.4	10.4	12.4	SE	29.9	44.0	2.8
	2003	14.3	11.6	13.0	S	29.0	44.3	3.6
	2004	10.6	11.0	9.7	SE	28.8	44.7	2.7
	2005	12.9	12.3	7.6	S	28.3	44.8	3.6
	2006	10.8	9.9	6.8	S	29.4	42.4	3.1
	2007	11.2	9.9	6.2	S	29.5	45.5	3.8
	2008	10.6	9.8	6.2	S	29.4	44.9	4.2
	2009	11.7	10.4	5.5	S	31.2	45.0	3.5
	2010	11.4	10.3	5.7	S	29.4	44.9	2.9
	2011	11.5	10.4	3.9	S	29.8	44.8	3.8
	Avg	11.9	10.7	7.9	S	29.4	44.4	3.4

Sta	Year	Air Temp (c)	Water Temp (c)	Wind Vel. (knots)	Wind Dir	Salinity (ppt)	Water Depth (f)	Secchi (m)
8	2001	12.8	11.3	9.5	SE	29.0	28.9	3.1
	2002	12.1	10.3	11.8	SE	30.0	29.4	2.4
	2003	13.7	11.2	11.6	SE	28.1	28.9	3.1
	2004	10.8	11.0	9.1	SE	29.3	28.7	2.4
	2005	12.8	12.1	7.7	S	28.5	29.8	3.3
	2006	11.8	10.5	6.7	S	29.0	30.4	3.0
	2007	11.2	9.9	5.5	S	29.5	29.8	3.2
	2008	10.9	9.7	5.9	SW	29.2	29.9	3.7
	2009	11.6	10.5	5.9	S	31.2	29.6	3.4
	2010	11.7	10.2	5.2	SE	29.3	29.9	2.7
	2011	12.2	10.3	3.8	S	29.8	29.6	3.2
	Avg	12.0	10.6	7.5	SE	29.4	29.5	3.0

Appendix A17.–Yearly mean values for selected chemical and physical variables collected during the offshore test fish project, 1979–2011.

Year	Air Temp. (c)	Water Temp. (c)	Wind Vel. (knots)	Salinity (ppt)	Secchi (m)
1979	12.4	12.2	5.9	25.0	5.7
1980	12.4	10.0	8.2	24.8	4.2
1981	13.4	11.0	10.1	23.1	4.1
1982	12.0	8.5	9.0	20.3	5.0
1983	14.9	10.9	9.4	20.6	4.7
1984	13.5	10.8	9.1	–	5.3
1985	10.8	8.2	9.2	28.0	5.5
1986	10.6	9.1	8.2	–	5.4
1987	12.6	10.1	4.1	28.4	5.1
1988	14.2	9.1	8.9	30.2	4.7
1989	13.1	10.0	4.4	27.7	4.7
1990	12.3	11.4	8.5	21.3	4.6
1991	10.9	9.9	6.6	–	4.1
1992	12.0	11.1	5.4	28.4	4.3
1993	13.5	10.5	6.9	26.2	5.0
1994	13.0	10.0	9.3	29.0	6.0
1995	13.1	9.5	7.9	26.5	4.6
1996	12.6	10.0	9.1	30.8	4.7
1997	13.8	10.5	10.0	30.6	4.0
1998	12.5	10.3	8.3	30.0	5.4
1999	13.4	10.3	12.4	30.2	4.5
2000	13.5	10.5	12.2	30.1	5.2
2001	12.9	10.7	10.7	30.1	5.2
2002	12.5	10.1	13.0	30.4	4.5
2003	14.2	11.3	12.9	29.6	5.0
2004	10.7	10.4	8.5	30.0	4.7
2005	13.0	11.7	7.1	29.4	5.0
2006	11.3	10.3	7.2	28.4	4.6
2007	11.0	9.4	5.5	30.2	5.3
2008	10.5	9.3	6.3	29.7	5.3
2009	11.4	10.0	6.1	31.8	4.7
2010	11.2	9.9	5.8	30.1	4.7
1992-2010 Avg	12.4	10.3	8.7	29.5	4.9
2011	11.5	9.8	3.9	30.4	5.1